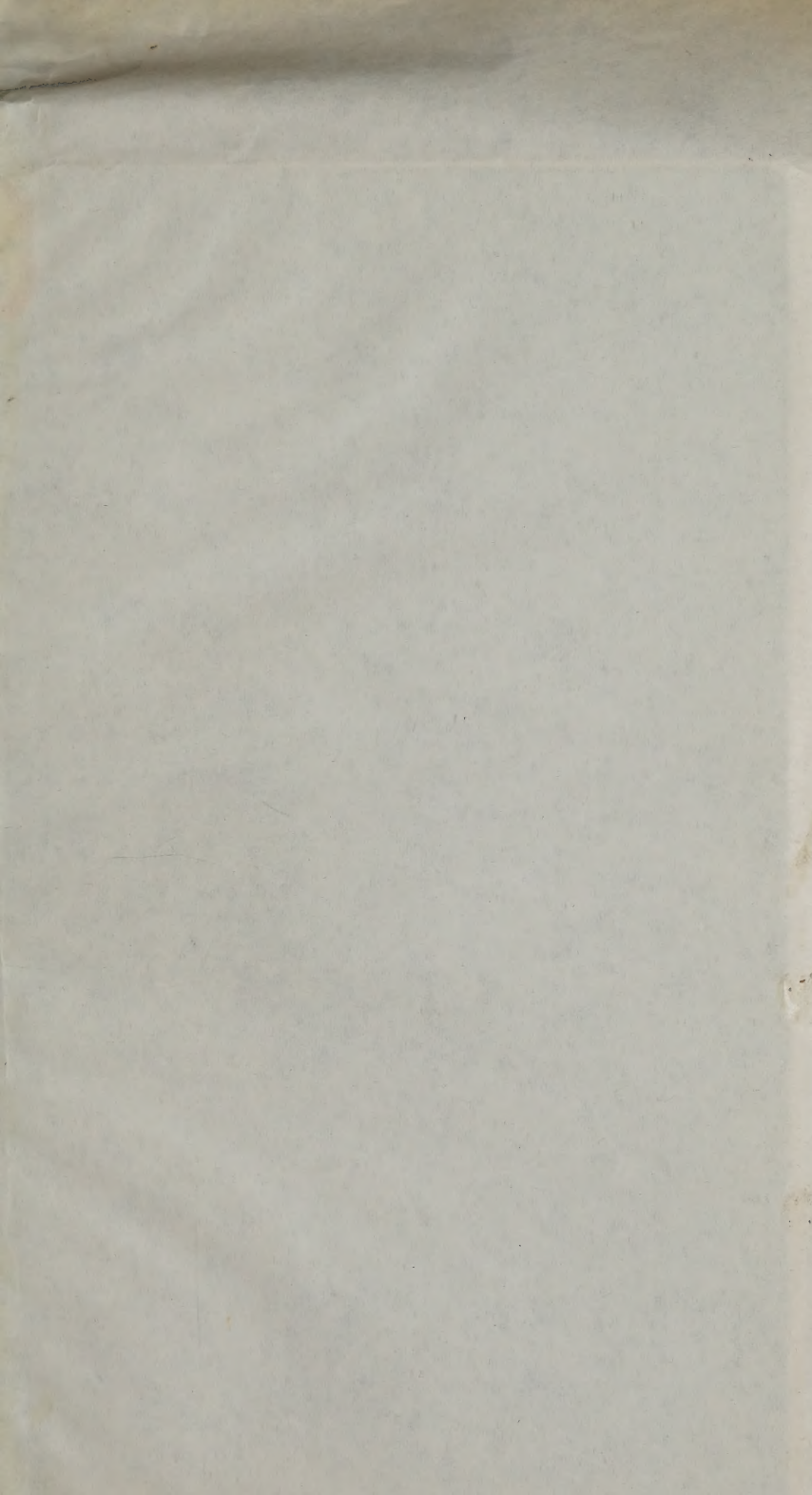


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THE BULLETIN
OF THE
University of Washington

SERIES I

JULY, 1908

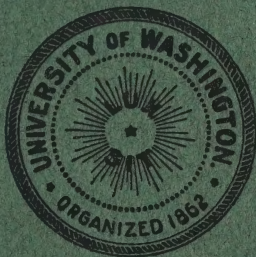
NUMBER 46

School of Mines

CATALOGUE

FOR

1907-8



OLYMPIA, WASH.
C. W. GORHAM, PUBLIC PRINTER
1908

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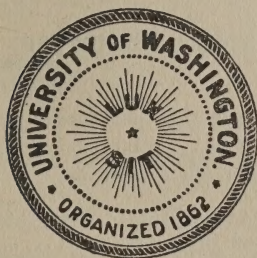
CATALOGUE for 1907-8 and

ANNOUNCEMENTS for 1908-9

OF THE

SCHOOL OF MINES

UNIVERSITY OF WASHINGTON



SEATTLE

OLYMPIA, WASH.:

C. W. GORHAM, PUBLIC PRINTER

1908

UNIVERSITY CALENDAR, 1908-1909.

FIRST SEMESTER.

Examinations for Admission.....Monday, Tuesday, Sept. 14, 15
Registration Days.....Monday, Tuesday, Sept. 14, 15
Recitations Begin.....Wednesday, Sept. 16
Examinations for Removing Conditions.....Sept. 21-25
Thanksgiving Vacation.....Nov. 25, 12 m. to Nov. 30, 8:00 a. m.
Examinations for Removing Conditions.....December 14-18
Christmas Vacation.....Dec. 24, 8:00 a. m. to Jan. 5, 8:00 a. m.
First Semester Closes.....Friday, Jan. 29

SECOND SEMESTER.

Registration Days.....Monday, Tuesday, Feb. 1, 2
Recitations Begin.....Wednesday, Feb. 3
Washington's Birthday.....Feb. 22
Examinations for Removing Conditions.....March 8-12
Junior Day.....Friday, April 30
Semester Examinations Close.....May 28
Baccalaureate Sunday.....May 30
Alumni Dinner.....Monday, May 31
Commencement.....Wednesday June 2

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SCHOOL OF MINES.

FACULTY.

THOMAS FRANKLIN KANE, Ph. D., *President*.

MILNOR ROBERTS, A. B., Professor of Mining Engineering and Metallurgy, *Dean*.

HENRY LANDES, A. M., Professor of Geology and Mineralogy.

ALMON HOMER FULLER, C. E., Professor of Civil Engineering.

JOHN THOMAS CONDON, L. L. M., Professor of Law.

*HORACE BYERS, Ph. D., Professor of Chemistry.

TREVOR KINCAID, A. M., Professor of Zoology.

FREDERICK ARTHUR OSBORN, Ph. D., Professor of Physics.

ROBERT EDOUARD MORITZ, Ph. D., Professor of Mathematics and Astronomy.

EVERETT OWEN EASTWOOD, B. S., C. E., Professor of Mechanical Engineering.

VICTOR MORTON PLACE, A. B., Professor of Physical Culture.

CHARLES CHURCH MORE, C. E., Associate Professor of Civil Engineering.

JAMES EDWARD GOULD, Ph. B., Assistant Professor of Mathematics.

HENRY KREITZER BENSON, Ph. D., Assistant Professor of Chemistry.

VANDERVEER CUSTIS, Ph. D., Assistant Professor of Economics.

FRANK MARION MORRISON, A. B., Assistant Professor of Mathematics.

LOREN DOUGLAS MILLIMAN, A. B., Assistant Professor of Rhetoric.

IRVIN WALTER BRANDEL, Ph. G., Ph. D., Assistant Professor of Chemistry.

ROBERT EVSTAFIEFF ROSE, Ph. D., Acting Assistant Professor of Chemistry.

* Absent on leave, 1907-8.

CHARLES M. HARRIS, C. E., Instructor in Civil Engineering.

GEORGE SAMUEL WILSON, B. S., Instructor in Mechanical Engineering.

HENRY LOUIS BRAKEL, A. M., Instructor in Physics.

FRANK EDWARD JOHNSON, E. E., Instructor in Electrical Engineering.

HENRY LEE BOWLBY, B. S., Instructor in Civil Engineering.

SAMUEL THOMAS BEATTIE, Instructor in Shop Work.

CLARENCE RAYMOND COREY, E. M., Instructor in Mining and Metallurgy.

GEORGE JAMME, Lecturer on Coal Mining.

HARVEY L. GLENN, B. S., Lecturer on Assaying of Bullion.

ROGER TAYLOR, B. S., Lecturer on Copper Smelting.

GEORGE IRVING GAVETT, B. S., C. E., Instructor in Mathematics.

WILLIAM VERNON LOVITT, A. M., Instructor in Mathematics.

CHARLES EDWIN WEAVER, Ph. D., Instructor in Geology.

SANDY MORROW KANE, Instructor in Metalwork.

JESSE AARON JACKSON, Instructor in Civil Engineering.

JAMES H. HANCE, B. S., Graduate Assistant in Mining.

GEORGE W. NELSON, Assistant in Metallurgy.

GENERAL INFORMATION.

The School of Mines of the University of Washington offers two four-year courses, one in Mining Engineering and the other in Geology and Mining, each leading to the degree of Bachelor of Science. In addition to these a special course is given for experienced mining men.

A mining engineer's training may be divided into two rather distinct parts. The first includes the general studies common to most engineering courses, such as physics, chemistry, mathematics, drawing, surveying, and manual training. On the foundation afforded by these subjects is built up the more purely technical part of the preparation. In this would be classed the various branches of geology, mineralogy, metallurgy, and mining.

The technical knowledge demanded of a mining engineer covers an unusually broad field. In its very nature it depends to a great extent upon familiarity with the actual conditions of work, therefore the opportunity to study mining and metallurgi-

cal enterprises is a necessary adjunct to University instruction. The laboratories and equipment described in this bulletin give every facility for carrying on the engineering courses, while the location of the School of Mines is especially convenient for making visits to mines and smelters.

Mines of gold, silver and copper are being operated on the western slope of the Cascades near Mt. Baker, at Monte Cristo, Index, Skykomish, in the Tahoma, St. Helens, and other nearby districts. The mining of three million tons of coal each year from the Puget Sound and Roslyn regions places Washington first among the coal-producing states of the Pacific slope. The Tacoma Smelting Works of the American Smelting and Refining Company is a thoroughly modern plant, equipped with several lead and copper furnaces, copper converters, an electrolytic copper refinery producing thirty tons of refined copper per day, a bag-house, etc. The Everett smelter produces refined lead and arsenic.

Water power plants with a combined output of 44,000 horse power are located at Snoqualmie Falls, Electron, and Cedar River, all near Seattle. The electricity generated is transmitted to the cities of Puget Sound by high tension lines.

The shipyards of the Moran Company, where the battleship Nebraska was constructed, the Washington and Vulcan Iron Works, and many works of other kinds are in operation in Seattle. In the immediate neighborhood, several railway companies are constructing new lines.

These engineering works offer excellent examples of practice. University students pay frequent visits to the mines and plants, and thus have an opportunity of studying the development of properties in somewhat the same way that a mining engineer watches work in his charge. Partly as a result of familiarity with the details of practical work, in addition to technical training, students have been fortunate in obtaining positions quickly. At present nearly every graduate of the School of Mines is engaged in practicing his profession, while many of the undergraduates hold good positions during the summer months. There is always a demand for younger students as assistants on mine, railway, and geological surveys, or as draughtsmen, mine-helpers, etc.,—positions in which valuable experience may be gained while wages are being earned.

LABRATORIES.

STAMP MILL AND CONCENTRATING PLANT.

East of the University power house stands the "mill" of the School of Mines, a frame building forty by one hundred ten feet in area. At the front end is a drafting room with two offices adjoining. The two-ton cupola and down draft forges with blowers, fans and motor, occupy the middle portion of the building.

The rear end is built on three benches, after the usual arrangement of concentrating plants in the West. This admits of handling the material mostly by gravity. The machinery is arranged in two parallel groups, one side for gold-silver ores and the other to treat copper, lead, zinc, etc. A sample on being received is stored in bins on the ground floor at the upper end of the mill. It is elevated to a small deck above the third floor, dumped on a grizzly with 3-4-inch openings and the over-size broken in a six by six-inch Dodge breaker. The broken rock is then directed to a suspended Challenge feeder, if intended for the stamps, otherwise to a roll feeder. The three stamps of the battery weigh three hundred pounds each and fall at the rate of ninety drops per minute. The pulp passes over silvered copper plates, through a mercury trap of Black Hills pattern, and, if desired, it may be passed through a Browne hydrometric sizer. The classified product may be directed by launders to one or more of the following: Frue vanner; Overstrom diagonal table; Wilfley slimer; revolving slime table; New Standard concentrator. Ores to be concentrated are fed by a Taylor roll feeder to a pair of nine-inch sampling rolls. The product is sampled automatically or may be diverted to a sampling floor of boiler plates where it is quartered by hand, the final sample being crushed at the assay shop. The main stream of ore passes through a trommel and is jigged in a three-compartment single Harz jig with screens nine by fifteen inches. The jig tailings may be treated on any of the tables mentioned. Screening tests are made by means of a power driven shaking screen with six decks of screens.

Power for the battery shaft, breaker, feeders and rolls is derived from a shaft driven by a thirty horse power motor in the

forge room. A six horse power motor furnishes power to the concentrating tables. The mill is well equipped with necessary tools for sampling and handling the ore and products. In addition, there is a set of tools for framing mine timbers by hand, an Ingersoll-Sergeant A-35 air drill, a Wood air drill and a Jeffrey coal mining drill, besides several sets of hand tools. Compressed air for running the drills is obtained from a compressor in the Mechanical Engineering department. The students have driven a small timbered tunnel on the campus, where experiments are made with different varieties of blasting powders.

ASSAYING.

The assaying laboratory is located immediately north of the Administration building. One room contains six stationary wind furnaces, thirteen inches square; one large double muffle, heated by coal and coke; desks for fifty students; eight ore balances and tables for preparing charges, and hand sampling equipment. An adjoining room contains a Hoskins gasoline pressure tank, five burners to heat muffles and fusion furnaces, a Brown cupel machine, two Denver Fire Clay Company's double muffle coal furnaces, a sampling floor, bucking boards, mortars, pans, lockers and suitable tools.

The crushing equipment consist of a Sturtevant roll-jaw crusher, size 2 by 6 inches, an Allis-Chalmers sample grinder and a Braun disc pulverizer, all driven by a 2-h. p. motor.

High temperatures are obtained by means of a Heracus electrically heated tube furnace 60 cm. long, mounted on trunnions, and a Hoskins electric furnace. Temperatures from 900 to 2000 centigrade are measured by an optical pyrometer after Wanner.

The balance room is supplied with a Keller button balance, sensitive to one two-hundredth of a milligram, Oertling, Ainsworth and Becker button balances, two Thompson analytical balances, and one Thompson button balance, sensitive to one two-hundredth of a milligram, and having multiple-rider attachment.

Wet assaying and analysis is carried on in a room fitted with gas and water for twelve desks. The University power plant supplies direct current for electrolytic work. Tanks for cyanide tests, a large hood, two pairs of cornet rolls and a well supplied stock room complete the equipment.

CIVIL ENGINEERING.

The surveying equipment is complete for all plane and topographic work. It consists of one Keuffel and Esser theodolite with horizontal circle reading to ten seconds, one Buff and Buff complete engineer's transit, one Heller and Brightly complete engineer's transit, one Gurley light mountain transit with solar attachment and Jones' patent latitude arc, one Keuffel and Esser mining transit with solar attachment, three Keuffel and Esser plain transits, three Lietz and Company transits, one Gurley railroad compass, two 20-inch Gurley wye levels, one Buff and Buff 16-inch wye level, one Lietz and Company 18-inch wye level, one Buff and Berger inverting dumpy level, one Gurley and one Keuffel and Esser plane table, both complete with alidades; sextant, hand levels, chains, tapes, level and stadia rods, and other necessary minor articles.

The two general draughting rooms are large and well lighted. They contain first class draughting desks, lock drawers, stools, cabinets, models and a large collection of drawings and blue prints illustrating current engineering practice. Thatcher's calculating instruments are available for the use of advanced students. The blue-print room provides for sun printing from any sized tracing up to twenty-eight by forty inches.

The hydraulic laboratory is equipped for testing small impulse wheels, meters and nozzels under heads up to sixty-five feet, and is provided with a Price Acoustic and a small Price Electric current meter for determining the flow of water in open channels.

The structural materials testing laboratory contains a 30,000 lb. Olsen, a 100,000 lb. Riehle, and a 200,000 lb. Olsen general testing machine with complete appurtenances for tension, compression and transverse tests of timber, iron, steel, stone, brick, and concrete. Transverse tests of full sized beams of timber or reinforced concrete are made for lengths up to sixteen feet. Power saws and a planer are available for preparing timber specimens.

The equipment for testing hydraulic cement is complete for all the ordinary tests as specified by the American Society of Civil Engineers and the American Society for Testing Materials. It contains a Riehle automatic shot testing machine of one thousand pounds capacity; a tempering oven; a boiler for accelerated tests; a Vicat needle apparatus and a set of Gillmore's needles

for determining initial and final set; galvanized iron pans, provided with a continuous supply of fresh water for storing briquettes; and sieves, moulds, mixing tables and other necessary accessories.

The library contains complete files of the transactions of the American Society of Civil Engineers, the transactions of the American Society of Mechanical Engineers, the Engineering News, the Engineering Record, the Electrical World, reports of the United States Geodetic Survey, reports of the United States Geological Survey, besides a collection of general engineering books, and the current engineering periodicals.

GOVERNMENT TIMBER TESTING SERVICE.

The United States Government through its Forest Service has designated the University of Washington to be the site of a Government Timber Testing Station. A Timber Testing Engineer has been stationed here and actual work in the investigation of the mechanical properties of Northwestern timber will be regularly carried on. Engineering students will be able to derive much interest and value from this. The structural materials testing laboratory is used jointly for this work and for University instruction and investigation.

MECHANICAL ENGINEERING.

The mechanical engineering laboratory is conveniently located on the first floor of the power house, adjoining the machine shop and engine room. There are available for indicating and testing one one-hundred horse-power Ball engine and one one-hundred fifteen horse-power McEwen engine. For experimental purposes there is a thirty horse-power engine, which can be run condensing or non-condensing, arranged to give practice in valve setting and speed regulation. The laboratory is further equipped with a three-inch centrifugal pump, a surface condenser with air and circulating pumps, indicators, gauges, barometers, thermometers, a pyrometer, Orsat gas apparatus, injector, calorimeters, speed indicators, and brakes. Suitable devices are provided for testing and calibrating the apparatus used. Scales and tanks are arranged for the weighing and measuring of water used. A seven horse-power engine, to burn gas or gasoline, is fitted especially

for experiment. In connection with the above are used the three horizontal tubular boilers of the power house. A seven horse-power steam turbine has been installed in such manner that it may be run either with steam under full pressure direct from the boiler or with exhaust steam from the laboratory engine, and in either case the turbine itself may exhaust into the atmosphere or vacuum, several sets of nozzles being available for the various conditions.

It is contemplated that the following apparatus will be installed for use in 1907-8: air compressor and air brake outfit, suction gas producer plant, belt testing and oil testing machines, dynamometers and fuel calorimeters.

The wood-working shop is equipped with lathes and benches, band saws, circular saws with boring attachment, planer, wood trimmer, and the necessary accessories.

The machine shop contains modern high speed lathes with turret attachment, planer, shaper, drill press, a universal milling machine, a universal grinding machine, metal shop saw, emery wheels, and a complete equipment for bench and vise work.

The forge shop is equipped with down draft forges with suitable blower and necessary accessories.

The foundry is provided with a cupola of two tons capacity and the necessary accessories.

PHYSICS AND ELECTRICAL ENGINEERING.

The laboratories set apart for the use of the departments consist of: (1) A general laboratory, thirty by seventy feet; (2) an electrical testing room with four piers; (3) a photometry room; (4) a dynamo laboratory and a battery room; (5) a shop.

The laboratories are supplied with apparatus from the best American and European makers. Among the more important pieces of apparatus may be mentioned: (1) Standard balances, cathetometer, a mercury air pump and a Geneva Society straight-line dividing engine with microscopes, so that it may be used as a comparator; (2) Helmholtz resonators and a double siren, chronograph with fork; (3) Boy's radio-micrometer, Dulon and Petit's absolute expansion of liquids apparatus, Bertholet's heat of vaporization apparatus, and a Waterman calorimeter; (4) a spectro-goniometer, two spectroscopes, polarimeter, a refractometer, a Fresnel's optical bench complete, a Rowland concave grat-

ing, a Zeiss spectrometer, and an Abbe-Pulfrich interferometer; (5) Kelvin composite balance, Kelvin electrostatic voltmeter, sixteen Weston voltmeters and ammeters, two Weston indicating Wattmeters, five recording Wattmeters, Reischsanstalt resistances, Kohlrausch bridge, Hartman & Braun's electrolytic resistance apparatus, standard condensers, Thompson galvanometers, etc.; (6) a storage battery of seventy cells, six transformers, two direct current 110-volt generators, 5-k. w. rotary converter, Fort Wayne 3-phase alternator, Fort Wayne 5-h. p. synchronous motor; La Roche alternator; 3-h. p. three-phase induction motor and a 5-h. p. single-phase induction motor from General Electric Co., a Wagner 5-h. p. single-phase induction motor, a Bullock 5-h. p. three-phase induction motor, a 6-h. p. D. C. motor, a 25-h. p. D. C. motor, etc.; (7) Lummer-Brodhun photometer with three meter track, a Bunsen screen, a Mathews integrating photometer, Standard lamps from the New York Testing Laboratory and the National Bureau of Standards.

The Commercial Electrical Laboratory (Power House) has the following equipment:

- (a) D. C. 500 volts, 75 K. W. Westinghouse dynamo.
- (b) A. C. single phase, 1100 volts, 60 K. W. dynamo.
- (c) A. C. single phase, 35 K. W. Westinghouse dynamo.
- (d) D. C. 110 volts, $22\frac{1}{2}$ K. W. Northern dynamo.

The general laboratory is supplied with a number of standard reference works. A number of the more prominent periodicals in physics are constantly on file, such as Philosophical Magazine, Physical Review, Astrophysical Journal, Wiedemann's Annalen and Beiblaetter, Journal de Physique, Nature, Science, London Electrician and Electrical World and Engineer, American Journal of Science, Street Railway Review, etc.

GEOLOGY.

The geological laboratories are four in number, three of them occupying rooms on the first floor of Science hall, at the right of the main hallway, with the fourth laboratory in the basement. The largest room, thirty-eight by forty-five feet, has been especially designed for mineralogy, but it is used as a laboratory for general geology as well. It is supplied with eight tables, made with tile tops and provided with gas fixtures, which accommodate sixty-four students at one time. For laboratory work in general

geology there are working collections of minerals, rocks, and fossils, as well as sets of geologic and topographic maps. For work in mineralogy there are several cabinets filled with collections of minerals for descriptive and determinative work, collections of natural crystals, wood models, blowpipe sets, etc.

The petrographical laboratory, twenty by twenty-two feet adjoins the one just described. For work in petrography there is provided a large lathe fitted with a diamond saw and grinding plates, run by an electric motor, and several petrographical microscopes with all accessories. The room is supplied with tile-topped tables similar in pattern to those of the mineralogical laboratory. The working collections include a large variety of rock specimens, and sets of thin sections of minerals and rocks for use with the microscope. Leading from this laboratory is a large dark room, well arranged for photographic work.

The laboratory for physiography, twenty-two by twenty-three feet, lies across the hall from the one last described. It is well provided with maps, models, meteorological apparatus and like equipment. At the present time this room also contains the library of the State Geological Survey.

A room in the basement, immediately beneath the physiographic laboratory, is used as a workshop for the construction of relief maps or models. It is a large and well-lighted room, has a concrete floor, and is in every way well adapted for work with clay and plaster.

CHEMISTRY.

The laboratories devoted to the departments of chemistry and pharmacy are capable of accommodating two hundred and twenty students working at one time. They consist of four laboratories, a stock room, a weighing room and two private laboratories, situated in the Administration building; two laboratories, two balance rooms, two private laboratories and a stock room situated in a temporary building near the Administration building. The laboratories are adequately equipped with water, gas, electric lights, electrical current for experimental purposes, as well as with excellent desks and permanent apparatus.

The stock rooms contain supplies for four hundred students. Everything essential to the work of the department, covering about five years' work in chemistry, is included. The stock rooms are in charge of assistants; and at certain hours students are

permitted to borrow all needed apparatus which may be returned without charge if in good condition.

A temporary laboratory, a one-story frame structure, one hundred fifteen by sixty-five feet, designed to meet the immediate needs of the department of chemistry, was erected during the summer of 1905. It contains accommodations for about one hundred and forty students (working at one time).

OTHER LABORATORIES.

There are large, well-lighted laboratories in Botany, Zoology, and Psychology, and the following State Museums located at the University: Historical, Geological, Zoological and Botanical.

STUDENT EXPENSES.

TUITION.

Tuition is free to all students of the state of Washington in all colleges and schools of the University, except in the Summer School. In the Summer School the tuition is ten dollars, as the Summer School is conducted independently by members of the faculty.

BOARD AND ROOM.

In the two dormitories, one for men and one for women, board and rooms are furnished at cost. During the past year the price of board and room has been \$17.50 a calendar month. This includes heat and light. The rooms are furnished with a spring bed, table, dresser, wardrobe, and chairs; but the student is expected to supply his own bed linen, bedding, mattress, towels, floor rug, and any articles of luxury that may be desired.

A deposit of fifteen dollars, which is returned at the end of the year, must be made with the registrar in advance by all students desiring to stay at the dormitory. The charge to each student is simply large enough to maintain the dormitories in a manner that will insure comfortable rooms, wholesome food and generally healthful surroundings. The University does not desire to make any profit from the dormitories.

There is always a large number of students who prefer to obtain homes with private families. There are many opportunities for this, and the registrar is always ready to give information and assistance to students seeking such places. In the past the expense of board and lodging with private families has ranged from fifteen dollars to twenty-five dollars per month.

LABORATORY DEPOSITS.

The University does not desire to make any profit from the deposits paid by the students for work in the laboratories. In many cases no fees are charged, except for damage to apparatus, when payment for the cost of the damage is required. The other

deposits are based upon the average cost of materials used by the individual student in the laboratories. Laboratory deposits are made with the registrar in advance. These deposits in the several laboratories are as follows:

ASSAYING.—In assaying there is a laboratory deposit of ten dollars for course 1. A deposit of five dollars is also required to cover cost of materials furnished to students. At the end of the semester, if the student has not drawn out materials to the amount of five dollars, the balance is refunded. If he has exceeded that amount, he is expected to pay the difference.

CHEMISTRY.—At the beginning of each semester each student in chemistry will be required to make a deposit of ten dollars with the registrar before being assigned to his desk. Of this deposit there will be deducted the cost of chemicals, gas, water, etc., and the remainder, less breakage, will be returned.

GEOLOGY AND MINERALOGY.—In courses 1, 1a and 2 a deposit of one dollar is made, in courses 3 and 4 a deposit of two dollars is made.

METALLURGY.—In courses 2 and 3 the deposit is three dollars. In courses 5 and 6, five dollars each.

PHYSICS AND ELECTRICAL ENGINEERING.—Students are required to make a deposit of five dollars with the registrar. From this deposit is deducted pay for materials and repair of apparatus, and the remainder, less breakage, is returned.

SHOP WORK.—A deposit of three dollars is required of each student in wood work. A deposit of two dollars is required of each student in iron work.

STRUCTURAL MATERIALS.—A deposit of three dollars will be required for the course Structural Materials 10. This is to cover the cost of materials used. The unexpended balance will be returned.

ZOOLOGY.—For the courses in Zoology, involving laboratory work, a deposit is required to cover the estimated cost of the laboratory outlines, materials, and reagents used by the students. For the regular courses, the amount is one dollar for each hour's credit. In research work the amount of the deposit is subject to special arrangement, according to the nature of the investigation.

DIPLOMA FEE.

The fee charged to graduates is five dollars for each one receiving a baccalaureate or higher degree, or a diploma in pharmacy, and three dollars for each one receiving a normal diploma.

STUDENT HELP.

Many students who has found it necessary to support themselves while at the University have been enabled to do so by securing occupation of various sorts in the city. There is a limited amount of work which the Board of Regents is disposed to give to students. This includes assistance in the library, the laboratories, the engine rooms, and janitor work. The dining hall affords work for a number of students throughout the college year. Students needing work to help pay their way through the University are given every possible aid by the Faculty Committee on Student Assistance. There is also an employment bureau conducted by students to secure work for students who have to make their own expenses. The Registrar has a record of 303 men and 62 women who are paying all or part of their expenses for the school year of 1906-7. There is no reason why an ambitious and capable young man or woman desiring an education should not obtain it at the University of Washington.

ADMISSION.

The requirements for admission to the Freshman class of the School of Mines are:

English	4
Algebra	1½
Plane Geometry	1
Solid Geometry	½
Physics	1
Chemistry	1
Modern Language	2
History	1
Civil Government	½
Elective	2½
<hr/>	
Total	15

Students may be admitted:

(1) By presenting a certificate of graduation from an accredited school (for list see page 67, University Catalogue), covering the above subjects.

(2) By passing a satisfactory examination in above subjects.

It is desirable for the student to review his preparatory mathematics just before entering the School of Mines. By such a step much time will be saved and the work of the School will be rendered far more valuable.

SUMMER WORK.

Every mining student who is a candidate for a degree is required to spend a portion of his summer vacation in actual work in a mine, mill or smelter. Students in Course II may present geological field work as a partial substitute.

DEGREES.

The four year courses of the School of Mines lead to the degree of Bachelor of Science (B.S.) in mining engineering. The degree of Engineer of Mines (E.M.) is given to graduates in mining engineering who have practiced their profession for at least three years and who present a satisfactory thesis.

DEGREE WITH HONORS.

A degree with honors may be conferred upon any student who has been recommended by the faculty of the School of Mines.

COURSES OF THE SCHOOL OF MINES.

1. Course in Mining.

*First Semester—**Second Semester—*

FRESHMAN YEAR.

	Hours.		Hours.
Math., 1a (Plane Trig. Higher Algebra)	4	Math., 2a (Anal. Geom. Higher Algebra)	4
Chemistry, 1a (Gen. Inorg.) ..	4	Chemistry, 2a (Gen. Inorg.) ..	4
Civil Eng., 1a (Eng. Drawing) ..	4	Civil Eng., 1b (Eng. Drawing) ..	4
Rhetoric, 1 (Engl. Comp.)... ..	4	Civil Eng., 3a (Plane Surv.) ..	4
Mech. Eng., 1a (Woodwork) ..	2	Mining A	
Physical Culture, 1.....	2	Mech. Eng., 1b (Mine Timber) ..	2
	<hr/>	Physical Culture, 2.....	2
	16 + 4		<hr/>
			16 + 4

SOPHOMORE YEAR.

	Hours.		Hours.
Geology, 5 (Mineralogy)....	4	Geology, 6 (Crystallography) ..	4
Math., 5a (Anal. Geom.)....	2	Math., 6a (Calculus).....	4
Math., 5b (Diff. Calculus)....	4	Chem., 6b (Quant. Anal.)... ..	4
Physics, 1a	5	Physics, 2a	5
Civil Eng., 3b (Mine Surv.)..	3	Physical Culture, 4.....	2
Physical Culture, 3.....	2		
	<hr/> 18 + 2		<hr/> 17 + 2

JUNIOR YEAR.

	Hours.		Hours.
Metallurgy, 1 (Fire Assaying) ..	4	Metallurgy, 2 (Gen. Met.)... ..	4
Geology, 1a	4	Civil Eng., 3c (Topog. Surv.) ..	2
Civil Eng., 5a (Mechanics) ..	4	Civil Eng., 5b (Mechanics) ..	5
Political Science, 1a.....	4	Civil Eng., 6a (Hydraulics) ..	4
Mech. Eng., 3a (Forge, Foundry)	2	Mech. Eng., 5b (Machine Design)	1
	<hr/>	Mech. Eng., 4a (Machine Work)	2
	16 + 2		<hr/>
			16 + 2

SENIOR YEAR.

	Hours.		Hours.
Mining, 1 (Ore Dressing)....	4	Mining, 2 (Mining).....	4
Mining, 5 (Field Work).....	1	Mining, 6 (Mining Law)....	1
Metallurgy, 3 (Gold, silver) ..	3	Mining, 7 (Mine Examination) ..	1
Metallurgy, 5 (Wet Assaying) ..	3	Mining, 8 (Thesis).....	2
Metallurgy, 7 (Metal Problems)	1	Geology, 8 (Economic).....	4
Geology, 7 (Petrography)....	4	Geology, 11 (Field Work)....	1
	<hr/>	Elective (Engineering).....	3
	16		<hr/>
			16

II. Course in Geology and Mining.

*First Semester—**Second Semester—*

FRESHMAN YEAR.

Hours.	Hours.
Math., 1a (Plane Trig. Higher Algebra) 4	Math., 2a (Anal. Geom. Higher Algebra) 4
Chemistry, 1a (Gen. Inorg.) . 4	Chemistry, 2a (Gen. Inorg.) . 4
Civil Eng., 1a (Eng. Drawing) 4	Civil Eng., 1b (Eng. Drawing) 4
Rhetoric, 1 (Engl. Comp.) . . 4	Civil Eng., 3a (Plane Surv.) . 4
Mech. Eng., 1a (Woodwork) . . 2	Mining A 2
Physical Culture, 1 2	Mech. Eng., 1b (Mine Timber) . 2
—	Physical Culture, 2 2
16 + 4	16 + 4

SOPHOMORE YEAR.

Hours.	Hours.
Geology, 5 (Mineralogy) . . . 4	Geology, 6 (Crystallography) 4
Math., 5a (Anal. Geom.) . . . 2	Math., 6a (Calculus) 4
Math., 5b (Diff. Calculus) . . 4	Chem., 6b (Quant. Anal.) . . . 4
Physics, 1a 5	Physics, 2a 5
Civil Eng., 3b (Mine Surv.) . 3	Physical Culture, 4 2
Physical Culture, 3 2	—
18 + 2	17 + 2

JUNIOR YEAR.

Hours.	Hours.
Metallurgy, 1 (Fire Assaying) 4	Metallurgy, 2 (Gen. Met.) . . . 4
Geology, 1a 4	Geology, 6 (Physiography) . . 4
Mining, 4 (Coal Mining) . . . 2	Civil Eng., 3c (Topog. Surv.) 3
Political Science, 1a 4	Geology, 12 (Field Work) . . . 1
Elective (Science) 2	Elective (Science) 4
Mech. Eng., 3a (Forge, Foundry) 2	Mech. Eng., 4 a (Machine Shop) 2
16 + 2	16 + 2

SENIOR YEAR.

Hours.	Hours.
Mining, 1 (Ore Dressing) . . . 4	Mining, 2 (Mining) 4
Mining, 3 (Field Work) 1	Mining, 6 (Mining Law) 1
Metallurgy, 5 (Wet Assaying) 3	Mining, 7 (Mine Examination) 1
Geology, 7 (Petrography) . . . 4	Geology, 8 (Economic) 4
Geology, 9 (Paleontology) . . . 4	Geology, 11 (Field Work) . . . 2
—	Zoology, 12 (Evolution) 2
16	Mining, 8 (Thesis) 2
	16

III. SHORT COURSE FOR MINING MEN.

From January 5th to April 2nd the instructors in mining engineering offer a course for the benefit of mature persons who are interested in prospecting and mining. Admission to the classes is without examination. Instruction is given by lectures, laboratory exercises and visits to mines and plants in operation. The past experience and future aims of each student are taken into consideration, and the character of his work arranged accordingly.

During the first week of the course the instruction is of a general nature. Thereafter the students select those courses which best fit their needs. It is expected that a student shall elect only those courses which he can attend with considerable regularity. Students who satisfactorily complete a course of study are given a certificate stating the amount and character of work done. When a subject corresponds to one of the studies in the 4-year courses, University credits will be given for it. For students who return a second year, a special course is arranged in continuation of their previous work.

The advantages of the University laboratories and libraries are open to all. Students may board and room at the dormitories or elsewhere, as preferred. Occasional trips are made to the Tacoma and Everett smelters, the U. S. Assay Office in Seattle, the coal and metal mines and the hydro-electric plants near Seattle. Tests of ores are made in the complete concentrating and stamp milling laboratory described elsewhere. Miners and prospectors who have ore samples to be assayed or tested by millrun may perform their own tests with the assistance of the professors in charge, as soon as the necessary skill has been attained.

Those who are unable to devote their whole time to the work may omit one or more of the subjects listed below, except that subject 4 should be accompanied or preceded by subjects 1 and 3. There are no charges except the usual laboratory fees for material used. Deposits are made to cover the actual cost of supplies drawn by each student, the balance of the deposit being returned at the end of the course. The total expenses are as follows: Registration fee, three dollars; subject 1, five-dollar fee, five-dollar deposit; subject 3, two-dollar fee; subject 4, ten-dollar fee, five-dollar deposit; subject 5, two-dollar deposit. All fees must be paid and all deposits made at the beginning of each subject.

SUBJECTS.

A. MINERAL INDUSTRY. Tuesday evenings in March, 8 p. m. A series of three lectures illustrated by lantern slides showing views of the mining and metallurgical industries of the Pacific Northwest and Alaska. [Roberts.]

1. GENERAL CHEMISTRY AND QUALITATIVE ANALYSIS. Laboratory practice in the determination of the common elements. Three lectures a week, and Saturday laboratory. [Byers.]

2. GEOLOGY. Lectures on the elements of geology, the common varieties of rock, metalliferous vein and ore deposits, etc. Twice a week. [Weaver.]

3. MINERALOGY. Instruction and practice in blowpipe analysis, with lectures upon the common minerals, and practice in the identification of minerals by field tests. Twice a week. [Weaver.]

4. FIRE ASSAYING. Lectures on sampling, preparing ores for assay, furnaces, fuels, reagents, and the fire assay of gold, silver, lead and tin ores. The laboratory work includes the testing of reagents, and the assaying of various ores. One lecture and three afternoons a week in laboratory. [Corey.]

5. MINING. Lectures on prospecting, development, mining systems, timbering, mine transportation, pumping, ventilation and hydraulic mining. Practice with stamp-milling and concentrating machinery, testing of ores, etc. Two lectures and one afternoon. [Roberts.]

6. MINING LAW. A series of lectures on the mining laws of the United States and Alaska. Illustrated by drawings and mine maps. Once a week. [Condon.]

7. FORGE. Practice in sharpening and tempering drill steel and picks; systematic training in the making and care of fires, and the application of various heats, drawing, punching, riveting, bending, twisting, upsetting, welding iron and steel, and making and tempering machine tools. [Kane.]

8. ADVANCED MINERALOGY. A continuation of descriptive mineralogy with much practice and determinative work. Prerequisite, 3.

9. QUANTITATIVE ANALYSIS. Gravimetric and volumetric analysis. Talbot's Quantitative Analysis. Two afternoons a week. Prerequisite, 1.

10. WET ASSAYING. Assaying of bullion for fineness; assaying of copper by various methods; amalgamation assay. Prerequisite, 1. To be taken with 8.

DEPARTMENTS OF INSTRUCTION.

MINING ENGINEERING AND METALLURGY.

MILNOR ROBERTS, *Professor.*

CLARENCE RAYMOND COREY, *Instructor.*

GEORGE JAMME, HARVEY L. GLENN and ROGER TAYLOR, *Lecturers.*

JAMES HAROLD HANCE, *Graduate Assistant.*

MINING ENGINEERING.

A. MINERAL INDUSTRY. Second Semester. A series of three lectures illustrated by stereopticon views. Tuesday evenings in March, 8 p. m. An outline of the mining and metallurgical industries of the Pacific Northwest and Alaska, illustrated by views of typical mines, mills and smelters. Required of freshmen.

[Roberts.]

1. ORE DRESSING. First Semester. Two lectures and two laboratory periods. Lectures on crushing, sampling, concentrating, amalgamating and the arrangement of mills. Mill practice in breaking by hand and machinery, crushing by stamps, rolls and roller mills, amalgamation, panning, screen sizing, classifying, magnetic separation, concentration by jig, vanner, Overstrom table, Wilfley slimer, revolving slime tables and Standard concentrator, and the testing of ores by mill runs checked by sampling and assaying. Prerequisites: Metallurgy 2, Mechanical Engineering 5b.

[Roberts, Hance.]

2. MINING. Second Semester. Three lectures and one laboratory period. Lectures on sinking, tunneling, stoping, timbering, systems of mining, power generation, air compression, hoisting, transportation, drilling, explosives and cost keeping. Practice in machine drilling, blasting, ventilation, air compression and the planning of systems of mining and timbering.

[Roberts, Corey, Jamme.]

3. MILLING. First Semester. Two hours. One lecture and one laboratory period. Lectures and laboratory work on the details of a particular branch of ore dressing; for example, the concentration of fine sands and slimes. To be preceded or accompanied by Mining 1.

[Roberts.]

4. COAL MINING. First Semester. Two hours. Lighting, ventilation, haulage and all phases of the mining and preparation of coal for the market, with especial reference to the geological structure of the coal fields of the Pacific Coast and the local methods of mining. Occasional visits to coal mines.

[Roberts, Jamme.]

5. FIELD WORK. First Semester. One hour. One laboratory period (or its equivalent in total time required) and monthly seminar. Individual visits to a mine, mill, smelter or engineering work, to be followed by a report on field notes and sketches; or, the preparation of drawings and reports from notes taken during the preceding summer.

[Roberts and Corey.]

6. MINING LAW. Second Semester. One hour. Lectures with required reading on the mining laws of the United States and especially those of Washington and Alaska.

[Condon.]

7. MINE EXAMINATION. Second Semester. One hour. Ten days during the Easter holidays. The examination of a mine or mining district, to be made by the senior class in connection with Mining 2. Field notebooks to be checked daily.

[Roberts and Corey.]

8. THESIS. Second Semester. Two hours. Subjects to be assigned. Weekly consultation.

[Roberts and Corey.]

METALLURGY.

1. FIRE ASSAYING. First Semester. One lecture and three laboratory periods. M., 9; Tu., Th., 1-5. The testing of reagents, the crushing, sampling, and assaying of ores, furnace and mill products for lead, silver, gold, copper and tin; also, the assay of base and dore bullion. Prerequisite, Chemistry 6.

[Corey, Glenn.]

2. GENERAL METALLURGY. Second Semester. Three lectures and one laboratory period. Tu., Th., F., 11; Th., 1-4. Lectures and laboratory experiments on the properties of metals and alloys, fuels, refractory materials, furnaces and the extraction of the common metals (except iron) from their ores; the latter half of the course confined to the smelting and refining of copper, lead, gold and silver. Required visits to smelters. Prerequisites, Geology 4, Chemistry 6, Metallurgy 1.

[Roberts, Taylor.]

3. GOLD AND SILVER. First Semester. Three hours. Tu., F., 10; W., 1-4. A continuation of Metallurgy 2. Devoted especially to the lixiviation and amalgamation of gold and silver ores. Prerequisites, Metallurgy 1 and 2.

[Corey.]

4. METALLOGRAPHY. Second Semester. Two hours. The constitution and microstructure of metals and alloys with special reference to iron and steel. Prerequisites, Chemistry 7 and Metallurgy 2.

[Roberts.]

5. WET ASSAYING. First Semester. Three hours. M., 10; M., F., 1-4. The technical methods for the determination of copper, lead, zinc, etc., in ores and furnace products. Prerequisite, Chemistry 6.

[Corey.]

6. METALLURGICAL ANALYSIS. Second Semester. Three hours. Laboratory practice in typical methods of analysis of coals, slags and industrial products, etc. Prerequisites, Chemistry 6 and Metallurgy 5.

[Corey.]

7. METALLURGICAL PROBLEMS. First Semester. One hour. Th., 10. Physical Chemistry for the metallurgist, slag calculations, etc. Prerequisites, Mathematics 1a, 2a; Physics, 1a, 2a; Chemistry 6; and Metallurgy 2.

[Corey.]

CIVIL ENGINEERING.

ALMON HOMER FULLER, *Professor*.

CHARLES EVAN FOWLER, *Lecturer*.

SAMUEL CHRISTOPHER LANCASTER, *Professor*.

CHARLES CHURCH MORE, *Associate Professor*.

HENRY LEE BOWLBY, *Instructor*.

CHARLES W. HARRIS, *Instructor*.

JESSE AARON JACKSON, *Instructor*.

SUBJECTS.

1a. ENGINEERING DRAWING. First Semester. Six sections. The elements of descriptive geometry including projections of points, lines and planes; instruction in use of instruments and practice in linear drawing; construction from printed descriptions in orthographic projection; lettering including the Roman and Gothic alphabets and a practical free hand alphabet for working drawings. Prerequisites, plane and solid geometry.

[Harris, Jackson.]

1b. ENGINEERING DRAWING. Second Semester. Continuation of Engineering Drawing 1. Curved surfaces, plane sections and section lining; intersection of simple geometric forms; rotation of points, lines and planes; warped surfaces.

[Harris, Jackson.]

3a. PLANE SURVEYING. Second Semester. Theory of chain, compass, and transit surveying and leveling; the adjustment and use of instruments, computations of area, maps. Prerequisites, Drawing 1 and Mathematics 1a.

[Bowlby, Jackson.]

3b. CITY AND MINE SURVEYING. Three hours. First Semester, until Christmas recess. Study of the precision necessary to be obtained; survey of a convenient portion of the city, and field and office work of laying out a new addition. Mining survey methods. Pen topography will be taken up for the remainder of the semester. Prerequisite, 3a.

[Bowlby.]

3c. TOPOGRAPHIC SURVEYING. Second Semester. Two hours. Mining students enter this course after Easter recess, omitting the work in colored topography. Base line measurements; transit triangulation; plane table and stadia work; maps. [Bowlby.]

5a. MECHANICS. First Semester. Statics and dynamics. Special attention is paid to practical applications. Original problems form a prominent feature. Prerequisites, Mathematics 6a and Physics, 1a and 2a. [More.]

5b. MECHANICS. Five hours. Second Semester. Continuation of 5a and Mechanics of Materials. Lectures, recitations and solution of problems. [More.]

6a. THEORETIC HYDRAULICS. Second Semester. Pressure; depth and stability of flotation, center of pressure, steady water through pipes and orifices, over weirs and in open channels; energy, impulse and reaction of a jet. Preceded or accompanied by 5b. Laboratory work. [Harris.]

ELECTRICAL ENGINEERING.

CARL EDWARD MAGNUSSON, *Professor.*

3. INDUSTRIAL ELECTRICITY. Three hours. Second Semester. Tu., Th., 9:45; S., 9:00-12:30. Outline of industrial application. Prerequisite, Physics, 1a, 2a. *Professor Magnusson.*

MECHANICAL ENGINEERING.

EVERETT OWEN EASTWOOD, *Professor.*

GEORGE SAMUEL WILSON, *Instructor.*

SAMUEL THOMAS BEATTIE, *Instructor in Woodwork.*

SANDY MORROW KANE, *Instructor in Metalwork.*

SUBJECTS.

1a. CARPENTRY AND WOOD TURNING. One four-hour exercise each week of the first semester. The student will receive training in the use and care of wood-working tools. Instruction and practice will be given in sawing, planing, chiseling, champfering, grooving, framing, tenoning, mortising, dovetailing, splicing and gluing. Exercises in turning include consideration of speeds, and use of gorges, chisels, nosing tools, side tools, parting tools, and calipers. [Beattie.]

1b. PATTERN MAKING AND MINE TIMBERING. One four-hour exercise each week of the second semester. Same schedule as 1a. The pattern making includes the construction of core boxes and

such patterns as pipe fitting, valves, pulleys and machine parts. This is followed by a series of exercises in the framing of mine timbers according to various systems. [Beattie.]

3a. FORGE AND FOUNDRY. One four-hour exercise each week of the first semester. The student is given systematic training in the making and care of fires, and the application of various heats, drawing, punching, riveting, bending, twisting, upsetting, welding iron and steel, and making and tempering machine tools. In the foundry the student is given work in iron and brass; bench and floor moulding, coremaking, and is instructed with the view toward proficiency in management of the cupola. [Kane.]

4a. MACHINE WORK. One four-hour exercise each week of the second semester. Same schedule as 3a. The course begins with exercises in chipping, filing and scraping. These are followed by work on the lathe in both iron and brass including straight and taper turning, centering, chucking, screw cutting, boring, drilling and tapping, knurling and polishing. A few exercises on the other machines are given. [Kane.]

5b. ELEMENTS OF MACHINE DESIGN. Two hours. Second Semester. A continuation of Course 5a, consisting in the design of gearin, cone pulleys and belt transmission. Practice in tracing and blue printing will comprise a part of this work. Prerequisite, 5a. Until Easter recess for mining students. [Wilson.]

MATHEMATICS.

ROBERT EDOUARD MORITZ, *Professor.*

JAMES EDWARD GOULD and FRANK MARION MORRISON,
Assistant Professors.

GEORGE IRVING GAVETT and WILLIAM VERNON LOVITT, *Instructors.*

ERIC TEMPLE BELL, *Graduate Assistant.*

SUBJECTS.

1a. PLANE TRIGONOMETRY AND HIGHER ALGEBRA. First Semester. The work in algebra deals with topics supplementary to the work in trigonometry, such as complex numbers and their trigonometric representation. DeMoivre's theorems, the theory of logarithms, the logarithmic and trigonometric tables, the sine and cosine series, and the trigonometric solution of the cubic.

[Gould, Gavett, Bell.]

2a. ANALYTIC GEOMETRY AND HIGHER ALGEBRA. Second Semester. The fundamental conceptions and theorems in plane analytical geometry; the construction of loci from their equations; the deduction of the equations to loci from given conditions; transformation of coordinates; the straight line. The algebra consists of lessons supplementary to the analytical geometry, viz.: determinants; indeterminants and limiting values; interpretation of imaginary and infinite roots; elementary theorems in the theory of equations; etc. Prerequisite, 1a.

[Gould, Gavett, Bell.]

5a. ANALYTIC GEOMETRY. Two hours. First Semester. Application of analysis in the study of the conic sections and other plane curves. Introduction to solid analytics. Prerequisites, 1a and 2a.

[Moritz, Morrison.]

5b. DIFFERENTIAL CALCULUS. First Semester. A study of the infinitesimal calculus, with special reference to the needs of engineers. Prerequisites, 1a and 2a.

[Gould.]

6a. DIFFERENTIAL AND INTEGRAL CALCULUS. Second Semester. Continuation of Course 5b.

[Gould.]

CHEMISTRY.

HORACE BYERS, *Professor.*

HENRY KREITZER BENSON, *Assistant Professor.*

SUBJECTS.

1a, 2a. ENGINEERING CHEMISTRY. This course consists of illustrated lectures supplemented by quizzes. Laboratory work during the first semester consists of illustrative experiments, many of which are quantitative. The work of the second semester is largely qualitative analysis. Smith's General Chemistry and Laboratory Manual are used and Byers & Knight in qualitative analysis. Prerequisite, a high school course in chemistry.

[Byers, Benson.]

6. QUANTITATIVE ANALYSIS. Second Semester. Gravimetric and volumetric analysis. Olsen's Quantitative Analysis. Twelve laboratory periods per week. Prerequisite, 2a or 5b. [Byers.]

GEOLOGY.

HENRY LANDES, *Professor*.CHARLES EDWIN WEAVER, *Instructor*.

1a. GENERAL GEOLOGY. First Semester. A semester's course for engineering students. Lectures and recitations. [Landes.]

5. MINERALOGY. First Semester. Descriptive and determinative mineralogy. Practice in the determination of unlabeled minerals by means of their physical properties and by blowpipe analysis. [Weaver.]

6. OPTICAL CRYSTALLOGRAPHY. Second Semester. Chemical and optical properties of crystallized matter. Demonstrations of the different methods of investigation of the rock forming minerals in thin sections under the microscope. Use of the polarizing microscope and preparation of thin sections. [Weaver.]

7. PETROGRAPHY. First Semester. Principles and methods of investigation of rock forming substances. A study of the distinguishing characteristics of the different groups and species of rocks with practice in their determination by modern petrographical methods. Preparation of thin sections. [Weaver.]

8. ECONOMIC GEOLOGY. Second Semester. A study of the origin and extent of metalliferous veins and ore deposits; varieties of coal, extent and locations of coal fields; gas and oil; origin, occurrences, and uses of clays; building and ornamental stones; minor mineral products of use in the arts and of commercial importance. Prerequisites, 1, 5 and 7. [Landes.]

9, 10. PALAEOLOGY. The general principles of the study of fossil organisms, with their geologic and geographic distribution. A laboratory study of the most important forms of fossil invertebrates. Excursions in the field in the vicinity of Puget Sound. [Weaver.]

11, 12. FIELD WORK. Instruction and practice in methods of field observation and in interpretation of results. A study of the geological conditions in the vicinity of Puget Sound with other more extended excursions.

[Weaver and Landes.]

ZOOLOGY.

TREVOR KINCAID, *Professor.*

1, 2. ELEMENTS OF ZOOLOGY. Tu., Th., 11:35. A general review of zoological science, involving a study of the structure, classification and habits of the types included in the great branches of the animal kingdom. Laboratory work, Tu., Th., or W., F., 1:30.

12. PROBLEMS IN EVOLUTION. Two hours. Second Semester. A discussion of fundamental biological problems, including natural selection, utility and heredity, together with reviews of important contemporary articles.

RHETORIC.

LOREN DOUGLAS MILLIMAN, *Assistant Professor.*

1. ENGLISH COMPOSITION. First Semester.

POLITICAL AND SOCIAL SCIENCE.

VANDERVEER CUSTIS, *Assistant Professor.*

1a. ELEMENTS OF POLITICAL ECONOMY. First Semester.

PHYSICAL CULTURE.

VICTOR MORTON PLACE, *Professor.*

APPARATUS AND FLOOR WORK. Section A, Tu., Th., F., 3:30; B, M., W., F., 3:30; C, Tu., Th., F., 4:30; D, M., W., F., 4:30.

REGISTER OF STUDENTS.

1907-'08.

GRADUATE STUDENTS.

Carr, Francis Easton, A. B.....Oberlin College
Fansett, George Richard, Ph. B.....Yale University
Hance, James Harold, B. S.....Northwestern University
Hurst, Frederic Gordon, C. E.....Lehigh University
Kennedy, Harold deSaulles, A. B.....
.....Washington and Jefferson College
Rohlf, Otto Diedrich, B. S.....Columbia School of Mines
Smalley, Dwight, A. B.....University of Colorado

SENIORS.

Bagshaw, Enoch Williams.....Seattle
Sharkey, Fred John.....North Yakima
Shay, Zacharius B.....Willapa
White, Eugene Ainsworth.....Seattle
Wimmler, Norman Lucius.....Seattle

JUNIORS.

Babcock, Frank Ellarson.....Everett
Hughes, Edward Frederick.....Snoqualmie
Knuth, Carl Arthur.....Springfield, Ohio
Lindsay, William Rufus.....Utsaladdy
Mackey, Walton Fletcher.....Seattle
Newell, Roy Edward.....Tenino
Roller, Floyd Huffman.....Wickersham
Thompson, Claude Sims.....Seattle
Webster, Wendell.....Hudson, Wis.

SOPHOMORES.

Behrens, Jerry Arthur.....Seattle
Bell, Roscoe West.....Seattle
Brower, Fred.....Spokane

Buwalda, John Paul.....	North Yakima
Crane, Harry Stewart.....	Seattle
Dunbar, Walter Clifford.....	Seattle
Ellis, Hubert Ingersoll.....	Seattle
Fettke, Charles Reinhard.....	Tacoma
Hammerland, Arthur Edward.....	Spokane
Heuss, Edward Charles.....	Seattle
Hulce, Edgar Montgomery.....	Sumner
*McLean, John James.....	Seattle
Murray, Wayne.....	Glens Falls, N. Y.
Rae, David Edward.....	Walla Walla
Smith, Joseph Lawrence.....	Seattle
Williams, Arthur Edward.....	Lille, Alberta
Wilson, Clay Verdon.....	Seattle

FRESHMEN.

Anderson, Edward Robert.....	Spokane
Bridgeman, Leland McC.....	Seattle
Brogan, Edward Irving.....	Seattle
Burnett, David Carton.....	Seattle
Canton, William Reynolds.....	Waterville
Clarke, George Smith.....	Everett
Cole, Henry Ambrose.....	Lewistown, Idaho
DeChesne, Victor.....	Ballard
Denny, Edward Harold.....	Seattle
Diether, Louis Meyer.....	Lewistown, Idaho
Drew, Byron King.....	Tacoma
Duff, John.....	Wenatchee
Furbush, Arthur Prentice.....	Seattle
Garcken, Paul Harold.....	Seattle
Gleason, Timothy Daniel.....	Montesano
Gleason, Villeroy.....	Seattle
Hallock, George Oakley.....	Seattle
Harris, Arthur Oscar.....	Seattle
Johnson, Frank Melvin.....	Seattle
Leve, Walter Hanson.....	Seattle
Livingstone, Carl Dorman.....	Seattle
Lockwood, Everett Wellington.....	Waterville

*Deceased.

McGillicuddy, Cornelius Oliver.....	Aberdeen
McKinley, David Alexander.....	Spokane
McPhee, John Alexander.....	Spokane
McRae, Duncan Wendell.....	Tacoma
Moxley, Richard Wellington.....	Bozeman, Mont.
Oliver, James Allen.....	Colfax
Rathbun, Vilas Richard.....	Seattle
Roth, Victor Henry.....	Bellingham
Stone, Joseph William.....	Seattle
Swarva, George Lewis.....	South Park
Thompson, Everett Voorhees.....	Tacoma
Vogue, Elmer Emanuel.....	Seattle
Williams, Snow Elder.....	Riverton, Nebr.

UNCLASSIFIED STUDENTS.

Cunningham, Allan.....	Seattle
Harper, Clarence S.....	Troy, Mich.
Kelsey, Howard.....	Seattle
Lavell, Arthur John.....	Seattle
Lewis, Harold Herbert.....	Seattle
Nelson, George Walter.....	Seattle
Prentice, Gordon S.....	Seattle
Thompson, Harold Adams.....	Seattle
Trott, Edward Payson.....	Winchester, Mass.

SHORT COURSE MINERS.

Campbell, Joseph Addison.....	Seattle
Cooper, William Wallace.....	Seattle
Dean, Peter E.....	Seattle
Doremus, Stephen Ralph.....	Seattle
Dudley, Erle Pratt.....	Spring Valley, Ill.
Duncan, Everett Bell.....	Seattle
Dyer, Joseph Keith.....	Winchester, England
Eaton, Byron Glenn.....	Shelton
Fansett, George Richard.....	New Haven, Conn.
Hesse, William Albert.....	Nome, Alaska
Ingraham, Ralph D.....	New York City
Isaacson, Swan.....	Elk City, Oro.
Jaquith, Robert Clarence.....	Hopkins, Minn.
Leen, Michael.....	Washougal
McClelland, John Cavette.....	Seattle
McMiniemee, John Stevens.....	Seattle
Meier, Robert.....	Nome, Alaska
Mulligan, A. B.....	Seattle
Nelson, Edward Phillip.....	Seattle
Quickstad, Adolf.....	Seattle
Shaffer, Thomas Winfield.....	Seattle
Smith, Edward.....	Milwaukee, Wis.
Smith, George Powell.....	Youngstown
Spratley, John.....	Dawson, Yukon Territory
Talboy, James H.....	Seattle
Treich, William Henry.....	Seattle

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10/11

BULLETIN

University of Washington

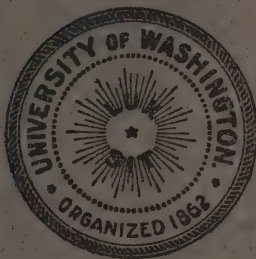
SERIES I

JUNE, 1911

NO. 57—PART 7

COLLEGE OF MINES

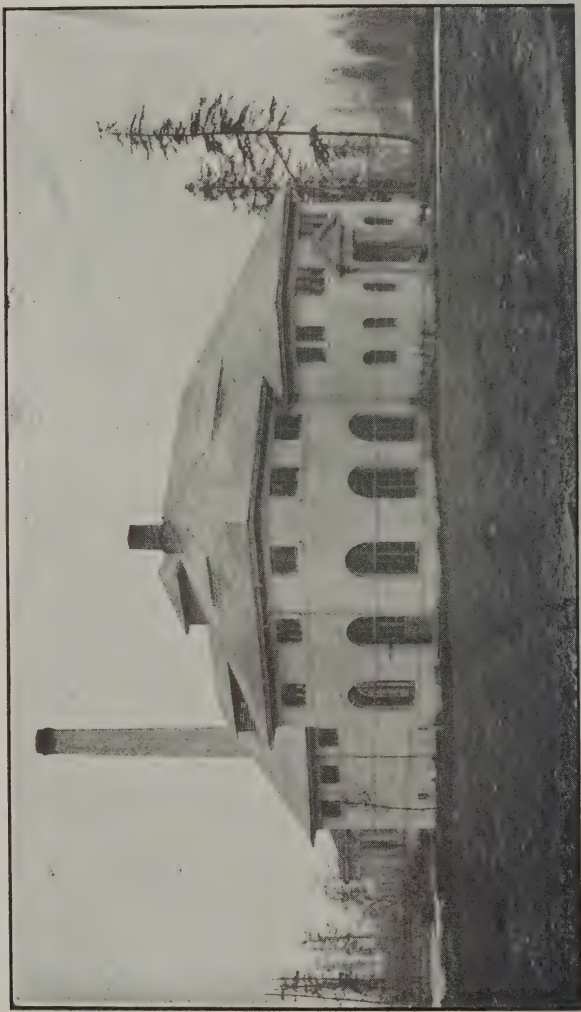
1910—1911



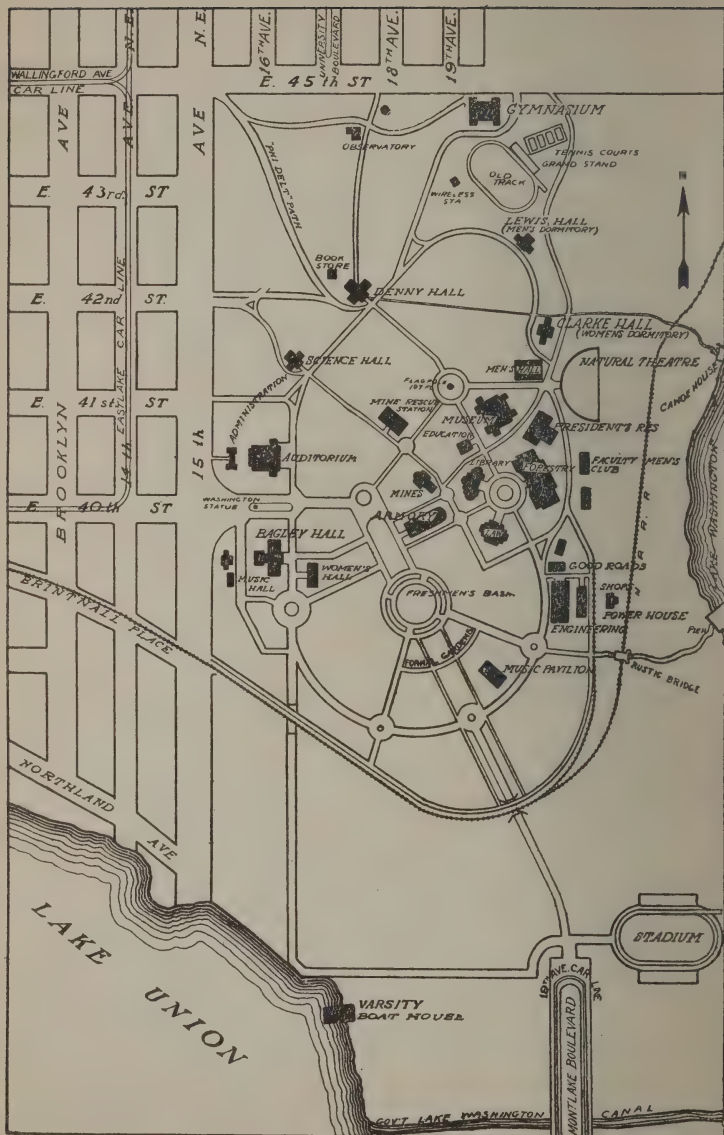
SEATTLE, WASHINGTON

Published Quarterly by the University
1911

Entered as second class matter at Seattle, under the act of July 16, 1894.



Mines Building, University of Washington.



CATALOGUE

For 1910-11 and

ANNOUNCEMENTS

For 1911-12

OF THE

LIBRARY
OF THE
UNIVERSITY OF ILLINOIS.

COLLEGE OF MINES

UNIVERSITY OF WASHINGTON



SEATTLE

OLYMPIA, WASH. :
E. L. BOARDMAN, PUBLIC PRINTER.
1911



Miners equipped with oxygen helmets, Mine Rescue Training Station.

1911-1912

Examination for admission....**Friday and Saturday, Sept. 15, 16**
Registration days...**Monday, Tuesday, Wednesday, Sept. 18, 19, 20**
Thanksgiving vacation..... { **Wednesday, Nov. 29, 6 p. m.,**
 { **to Monday, Dec. 4, 8 a. m.**
Christmas vacation..... { **Friday, Dec. 22, 6 p. m., to**
 { **Wednesday, Jan. 3, 8 a. m.**
Semester examinations... { **Wednesday, Thursday, Friday, Satur-**
 { **day, Monday, Jan. 24, 25, 26, 27, 29.**
First semester closes.....**Tuesday, Jan. 30**

Registration day, entering students.....	Wednesday, Jan. 31
Reregistration days.....	{ Thursday, Friday, Feb. 1, 2. One day for liberal arts students.
Recitations begin.....	Monday, Feb. 5
Washington's birthday, holiday.....	Thursday, Feb. 22
Spring vacation.....	{ Friday, March 29, 6 p. m., to Tuesday, April 9, 8 a. m.
Campus day and Junior day, holiday.....	Friday, May 10
Decoration day, holiday.....	Thursday, May 30
Semester examinations close.....	Friday, June 7
Baccalaureate Sunday.....	June 9
President's reception.....	Monday, June 10
Alumni day.....	Tuesday, June 11
Commencement.....	Wednesday, June 12

THE BOARD OF REGENTS

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Term Expires 1917.

HON. ALEX. F. MCEWAN.....Seattle
Term Expires 1911.

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COLLEGE OF MINES.

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FRANK MARION MORRISON, A. B., Michigan, Assistant Professor of Mathematics.

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JULIUS ADLER, B. S., Instructor in Civil Engineering.

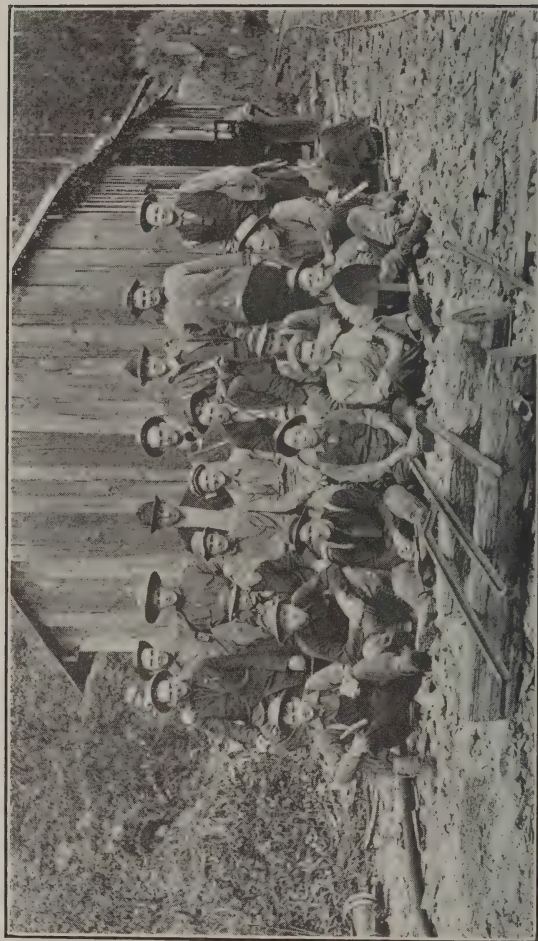
SAMUEL THOMAS BEATTIE, Instructor in Wood Work.

GEORGE BATES HARRINGTON, S. B., Mass. Inst. Tech., Lecturer on the Economics of Mining.

DAVID C. BOTTING, State Coal Mine Inspector, Lecturer on Mine Regulations.

EDWARD H. DENNY, Assistant in Metallurgy.

JAMES M. McDONALD, Assistant in Mining.



Students on mining excursion, 1911.

MINING AND METALLURGICAL INDUSTRIES AVAILABLE
FOR STUDY

Excellent opportunities for becoming familiar with mining and metallurgical operations are open to students in the College of Mines. The amount of time available during the college year for this purpose is not great and even by using the summer vacations it is impossible for a student to cover the whole field of local industries included in his chosen profession.

Mining machinery of the best types is in operation within easy reach of the University. Much of the heavy mining machinery used in the neighboring states and Alaska is built in the city of Seattle, while the patented machines, such as drills and concentrating tables of all makes are kept in stock and as working exhibits by the firms that supply the North Pacific coast regions. The application of hydraulic mining methods to city grading is being carried on locally on a very large scale and with the most approved pumping and piping appliances and methods. Equally important to the mining engineer are the operations of the steam shovels, which are used largely now in iron, copper and gold mining. The engineers in charge of these plants have given the mining students every opportunity to become familiar with the methods of planning and carrying on the work, and the same statement applies to the mine operators throughout the state.

A brief list of the other available works of interest includes coal mines, with the largest production west of the Rocky mountains; metal mines of gold, silver, copper, arsenic, antimony, iron, etc.; two cement plants, glass works, several stone quarries and dressing works; clay mines, clay and pottery works; gravel and sand pits with large production and approved methods; a region of varied geology with many economic minerals; the Tacoma and Everett smelters and refineries; the U. S. assay office; the Irondale steel plant of the Western Steel Corporation, and several plants engaged in metallurgical work.

LABORATORY DEPOSITS

The University does not desire to make any profit from the deposits paid by the students for work in the laboratories. In many cases no fees are charged, except for damage to apparatus, when payment for the cost of the damage is required. The other deposits are based upon the average cost of materials used by the

individual student in the laboratories. Laboratory deposits are made with the bursar in advance. These deposits in the several laboratories are as follows:

ASSAYING.—A deposit of fifteen dollars is made by all students registering for course 1. Any part of this amount that may be left to the credit of the student, after deducting the cost of materials consumed and breakage, is refunded upon order of the head of the department.

CHEMISTRY.—At the beginning of each semester each student in chemistry will be required to make a deposit of ten dollars before being assigned to his desk. Of this deposit there will be deducted the cost of chemicals, gas, water, etc., and the remainder, less breakage, will be returned.

ELECTRICAL ENGINEERING.—A deposit of one dollar for each hour of credit is made in all laboratory courses. The student also pays for any damage or injury that may come to any instrument or machine entrusted to him.

GEOLOGY AND MINERALOGY.—In courses 1, 1a, 1b, 2, 3, and 4 a deposit of one dollar is made; in courses 5, 6 and 9 a deposit of two dollars is made.

METALLURGY.—In course 1 the deposit is fifteen dollars; in courses 2, 3, 4, 5, 6, 7 and 8, ten dollars each; and in courses 9, 10 and 12, three dollars each.

PHYSICS.—Students are required to make a deposit of five dollars. From this deposit \$1.75 per hour of credit is deducted to pay for materials and repair of apparatus, and the remainder, less cost of breakage is returned.

SHOP WORK.—A deposit of two dollars each semester is required of students in wood work. A deposit of two dollars each semester is required of students in iron work.

DIPLOMA FEE.

The fee charged to graduates is five dollars for each one receiving a baccalaureate or higher degree, or a diploma in pharmacy, and three dollars for each one receiving a teacher's diploma.

STUDENT HELP

Many students who have found it necessary to support themselves while at the University have been enabled to do so by

securing occupations of various sorts in the city. There is a limited amount of work which the authorities are disposed to give to students. This includes assistance in the library, the laboratories, the engine rooms, and janitor work. The dining hall affords work for a number of men students throughout the college year. Students needing work to help pay their way through the University are given every possible aid by the Faculty Committee on Student Assistance. There is also an employment bureau conducted by students to secure work for students who have to make their own expenses. The official records of the recorder's office show that twenty-three (23%) per cent. of the students enrolled in 1910-11 are entirely self-supporting, while thirty-two (32%) per cent. more are partially dependent upon their own resources. There is no reason why an ambitious and capable young man or woman desiring an education should not obtain it at the University of Washington.

GROUNDS

The grounds are ample to meet every need of the University. There are three hundred fifty-five acres, all within the city limits of Seattle. The site lies between Lakes Union and Washington. It has a shore line of over one mile on Lake Washington and about a quarter of a mile on Lake Union. To the southern, or Lake Union, side the land slopes gently from the highest point in the northwestern corner, which is about two hundred twenty-five feet above tide level. Toward the eastern, or Lake Washington side, the land is level for more than half its width, where it breaks off in a series of benches, terraces, and ravines.

BUILDINGS

MINES BUILDING

The Mines building is a two-story pressed brick structure, formerly occupied by the University power plant and machine shops. The interior of the building has been remodeled, and now contains the machinery and apparatus, as well as the offices and lecture rooms of the School of Mines.

BAGLEY HALL.

The Chemistry building, Bagley Hall, is in the Ionic style of architecture and consists of a central motive in the form of a portico of four large columns with decorative French Ionic

capitals. Flanking the central motive on either side is a colonnade of pilasters of similar designs. The main cornice is highly ornamented with carved mouldings of rich, but classic character. The construction is of steel frame, concrete floors, and fire proof throughout; three stories high, and is fully furnished and equipped for the department of chemistry and the college of pharmacy.

ENGINEERING BUILDING

The Engineering building is of design particularly adapted to its purpose and is composed along simpler lines. The facade consists of a series of large round arches, surmounted by gables of the Spanish Misson type. It is of ivory brick with terra cotta gable trimmings to match. The building carries a large bracketed cornice of heavy overhang, supported by exposed wooden rafters of a pergola type with the natural stain.

FORGE AND FOUNDRY PRACTICE

The new forge and foundry is a typical building 64 feet by 144 feet floor space and 38 feet high in the middle. It has a second story at the north end, over the machinery shop, for the wood-working department, 64 feet by 50 feet floor space, and is constructed of heavy, surfaced and framed timbers with brick veneer, concrete foundations, and earthen floors for forge and foundry, and wooden floor at northern end for machine shop.

HYDRAULIC LABORATORY

The old brick power house, 42x80, on the shore of Lake Washington, has been converted into a hydraulic laboratory, and now houses the equipment incident to this work.

SCIENCE HALL

The Science hall, one of the oldest of the University buildings, is built of pressed brick with sadstone trimmings. It is three stories in height, with additional space in the basement and attic. It contains the departments of Geology, Zoology, Botany, Mathematics and the Psychological laboratory.

LIBRARY

LOCATION

The University library is located in the building formerly known as the Washington State building, erected by the state for

the A.-Y.-P. Exposition, and, while not designed for library purposes, it lends itself to such service better than many buildings constructed with that intention, having the chief characteristics of a good library building—adequately heated, lighted, ventilated and unobstructed space.

BOOKS

There are now 43,793 bound volumes in the library and probably 10,000 pamphlets. More than two-thirds of the volumes have been purchased within the last ten years, and have been selected with the modern idea of college work in mind, thus making it especially well suited to present needs. This is a designated depository library, and is fortunate in possessing almost a complete set of United States government publications, that are always available to any one who cares to consult them.

The Frederick James Grant Memorial Library of American History supplements the general library in that department.

PERIODICALS

The library receives regularly 389 periodicals, other than newspapers, including standard magazines and leading technical journals, both American and foreign, representing all phases of scholarship pursued in the University. Besides these, it receives the leading newspapers from the Pacific Northwest.

MUSEUM

The several collections composing the University museum, which is also the State museum, are housed in two buildings of the Alaska-Yukon-Pacific Exposition, viz., the California building, which is used as the main museum building and which contains the collections in anthropology, biology and geology, and the Forestry building, which is used primarily for the collections in forestry and botany.

The museum was first started in the late 70's by President A. J. Anderson, who brought together a small ethnological collection. This collection was added to from time to time by material received from Dr. David Starr Jordan, Prof. O. B. Johnson, the Young Naturalist's Society of Seattle, the Washington State Commissions of the World's Columbian Exposition, the Louisiana Purchase Exposition, the Lewis and Clarke Ex-

position, the Alaska-Yukon-Pacific Exposition, and from various friends of the University through gifts, loans and purchases.

GEOLOGY COLLECTIONS

The geological and mineralogical exhibits are arranged on the first floor of the museum building. The museum received from the Alaska-Yukon-Pacific Exposition the greater part of the exhibits of ores and minerals made in the Alaska and Mines buildings, making the mineral collection one of the largest in the west. The collections are as follows: (1) The large collections of Alaska ores and minerals; (2) the collection of minerals and ores from the northwest, especially from the State of Washington, is very extensive and complete; (3) one of the most valuable individual collections is the mineral collection known as the John R. Baker collection, consisting of more than a thousand specimens, mostly in crystalline form, from different parts of the world; (4) a very complete series of minerals, ores and geological specimens of Japan, which were received at the end of the Alaska-Yukon-Pacific Exposition; (5) the museum possesses a very large economic collection of clay and clay products, like brick, tile, terra cotta, pottery, etc., building and ornamental stones and marbles, coal and coke, and other useful minerals and rocks with their product; (6) a general collection of palaeontological specimens from the fossiliferous formation of the state, among which are a number of newly-described type specimens; (7) a college collection of paleontology from the Ward Natural Science Establishment, representing the characteristic invertebrate forms from the Palaeozoic and Mesozoic eras; (8) an extensive collection of maps, models and mounted photographs illustrative of the mining operations in Alaska.

LABORATORIES

MINES LABORATORIES

The Mines building is located among the new University buildings on the east side of the Court of Honor of the Alaska-Yukon-Pacific Exposition. All the offices, class rooms, collections, metallurgical laboratories, mining and ore-dressing equipment of the department of mining and metallurgy are located in this building. The structure is of brick, with concrete foundation and sandstone finish. Although it was designed and used for several years for the University power house, its solid walls, heavy framing, excellent lighting and open interior fit it admirably for the needs of a School of Mines building. The detailed plan of arrangement is as follows:

STAMP MILLING, CONCENTRATING AND COAL WASHING PLANT

The mining and ore-dressing machinery occupies the rear wing of the building. Ores are stored in the basement, which is occupied also by the sump tanks. Lots of ores to be used in mill tests are elevated by an Otis elevator to bins in a tower 60 feet in height. Below the bins are a grizzly, jaw-breaker, Taylor wall feeder, Cornish sampling rolls, samplers, trommel and shaking screens. Milling ore is fed to a Challenge feeder, leading to an Allis-Chalmers three-stamp battery. The pulp may be passed over amalgamated plates of both plain and silvered copper, through an Everett placer gold saver or through a Pierce amalgamator, thence through mercury traps. A single Harz jig with three compartments, and a Richards pulsator jig with four compartments follow the trommel.

The set of classifiers consists of a Richards pulsator classifier, Richards vortex classifier, tubular classifiers, and Browne hydro-metric sizer. Unwatering devices are also provided. The concentrators in use are a Frue vanner, Wilfley, New Standard, revolving slime table, Wilfley slimer and Overstrom table.

When making test runs, Richards-Locke automatic feeders are used to furnish a constant stream of ore to any desired piece of apparatus. Cement-making materials, road materials, paving blocks, and various artificial products are tested in an Abbe tube mill and Trojan mills. The heavy machinery rests on concrete foundations. The shafting is in two groups, driven by separate

motors. Three tanks standing at different levels above the machinery yield water at constant head. Slimes and tailings are caught in sumps, from which the water may be pumped back for use again, to prevent the loss of any ore during a run. A large stock of ores, containing a wide variety of minerals, is kept on hand for testing purposes. The washing and testing of coal has been a special feature of the laboratory work. In the summer of 1911 several pieces of equipment will be added in order to give every facility for testing the coals of the Pacific coast.

MINING

The mining equipment consists of complete sets of hand tools, timber framing tools, forge, Jeffrey coal drill, Ingersoll-Sergeant A-35 air drill, Wood air drill, air compressor, receiver, piping, mine fan, pump, full-size Trenton Iron Co.'s wire rope tramway in working order, and various devices in use about a mine.

Numerous exhibits of sets of ores from various mining districts, handsome single specimens of building stones, rock salt, the College of Mines by exhibitors at the Alaska-Yukon-Pacific Exposition. Among these may be mentioned the large model of the Renton mine, presented by the Seattle Electric Co.; the American Spiral Pipe Works exhibit, the Alundum exhibit, and the full series of Minnesota iron ores, maps and photographs presented by the Oliver Iron Mining Co.

Exhibits especially useful for study and comparative tests are the following: Coal from numerous mines in Washington, British Columbia and Alaska; sets of minerals to illustrate characteristics; ores of all the common metals and types of vein formations; and full sets of rock and ore specimens and mill products from the Alaska treadwell, Bunker Hill and Sullivan and De Lamar.

METALLURGY

The metallurgical furnaces occupy the east side of the College of Mines building. Four double-muffle coal-fired furnaces of the usual smelter size, six pot furnaces, two gas muffles, several gasoline muffle and combustion furnaces, a kiln for clay and brick testing, a retorting furnace, a coke oven, and the usual tools and appliances.

The desks, balance rooms, private laboratories, stock room, sampling room, and cyanide plant are located in the main build-



Some of the Short Session Miners, 1911.



Junior Class in Mining, 1911.

ing. The balance room is equipped with a Keller button balance, sensitive to one two-hundredth of a milligram, a Heusser Bros. button balance of equal sensitiveness; Oertling, Ainsworth, and Becker button balances; two Thompson analytical balances; one Thompson button balance, sensitive to one two-hundredth of a milligram, and having multiple-rider attachment, and one Ainsworth No. 28 analytical balance. The University power plant supplies direct current for electrolytic work. High temperatures are obtained by means of a Heraeus electrically-heated tube furnace 60 cm. long, mounted on trunnions, and a Hoskins electric furnace. Temperatures from 1,200 to 2,000 degrees centigrade are measured by an optical pyrometer after Wanner, while ordinary muffle heats are taken by electric and other forms of pyrometer.

The stock room is supplied with all materials usually needed in the building. Samples are reduced by means of a Sturtevant roll-jaw crusher, an Allis-Chalmers sample grinder, and a Braun disc pulverizer. The usual tools, split samplers, and a large iron sampling floor are provided.

On the second floor are the class rooms, drafting rooms, magazine stand, collections, etc. The dean's office is located in a balcony room, directly over the front entrance to the building.

There is an excellent collection of drawings, blue prints, photographs and models, illustrating mining and metallurgical subjects. Over four hundred stereopticon views of machinery, mines, plants, and mining districts are available for class room and special lectures. The University library contains practically all of the standard texts and reference books, besides a large collection of trade catalogues carefully filed, and complete sets of the transactions of the American Institute of Mining Engineers, the proceedings of the Institution of Mining and Metallurgy, the School of Mines Quarterly, the Mineral Industry, the Copper Handbook, and the publications of the United States Geological Survey, including a nearly complete set of the geologic folios.

UNITED STATES MINE RESCUE TRAINING STATION

The United States Mine Rescue Training Station, operated in connection with the College of Mines, occupies the building erected by the United States government for the Philippine exhibit at the A.-Y.-P. Exposition. This building was remodeled by the coal mine operators of Washington at a cost of \$2,000 to fit

it for its present use. It measures 50 by 140 feet and is 30 feet high. The office of the local director representing the United States Bureau of Mines occupies the southwest corner; next to this are the library and workshop. The "smokeroom," fitted with track and car, overcast airway, doghole, and smudge floors, is the largest of its kind in the country, measuring 25 by 50 feet. The miners' change room is fitted with shower baths and roomy lockers.

Several sets of the Draeger oxygen apparatus and pulmotor are kept on hand for practice as well as for use in mine rescue work.

The Mine Rescue Training Station was established by the coal mine operators of the State of Washington, in conjunction with the Technologic Branch of the United States Geological Survey. The University provided the building used by the government during the A.-Y.-P. Exposition for the Philippine exhibit, and the coal mining companies spent about \$2,000 in fitting it for a training station. It is now maintained by the United States Bureau of Mines. The Bureau of Mines keeps one of its Mine Rescue Cars, No. 5, in constant service in the states of the Pacific Northwest. H. M. Wolfin, B. S., a mining engineer of the bureau, is in general charge of operations in this region, with A. A. Flynn in local charge of this station, No. E.

The purpose of the station is to train miners in the use of oxygen helmets, which are used in cases of mine fires and explosions in both coal and metal mines. From ten days to two weeks' time is required for the course of training. The applicant is taught the construction of the apparatus and is required to wear it for four hours each day, in two periods of two hours each.

The practice is carried on in a room filled with gas which cannot be breathed without immediate danger, and the work to be performed is the same as that which would be required in actual mining operations or rescue work. The smoke room represents a portion of a mine, and is equipped with mine car, track, overcast, timbers and brick. Applicants who have completed the course of training are given a certificate to that effect.

INSTRUCTION FOR COAL MINING MEN

Miners taking the rescue training also receive instruction in the College of Mines on the subjects of mine gases, explosions, and the origin and distribution of Pacific Coast and Alaska coals.

Laboratory experiments are carried on to show the methods of analyzing coals and determining the uses to which they may be put. The methods of testing for permissible explosives at the Pittsburgh Station and the safe methods of charging, tamping and firing are explained. Lectures are given by State Mine Inspector Botting, Assistant Inspector Corey and government engineers.

CHEMISTRY

The chemistry laboratory, Bagley Hall, is a three-story concrete and steel structure, fire proof, with concrete floors and exterior of pressed brick. It consists of a main building, 166x61 feet, with an annex 64x64 feet. The annex consists of two floors, one of which is occupied by a lecture room capable of seating 450 students. This room is equipped with a lecture table, hoods, exhibition cabinets and projective lantern and all the apparatus needed for a modern lecture course in experimental chemistry. The lower floor consists of an assaying and industrial laboratory, which will be equipped with hundredth-unit models of industrial plants. It will also contain a shop with work benches, wooden and steel lathes, etc. There is also a large lavatory finished in marble throughout. A large well-lighted room is devoted to the departmental library, managed as a branch of the University general library.

The main portion of the building is provided with three lecture rooms on the third floor. One of these is so equipped that it may be used for a microscopic laboratory in connection with the lectures on materia medica and pharmacognosy. There are also several offices for members of the teaching staff and six private laboratories. A series of three stock rooms, connected by elevators and internal stairways, occupy the center of the building. These stock rooms contain a large stock of the most modern apparatus and supplies needed for the work which is carried on. One of these rooms, immediately behind the main lecture room, is subdivided and thus furnishes a preparation room for the lecturer's demonstrations.

The laboratories for the students are twelve in number and are assigned as follows:

Three laboratories are devoted to general chemistry; each is designed to accommodate 60 students working at one time and is so constructed that twice that number can be accommodated in sections. These laboratories are supplemented by two large weighing

rooms, equipped with good balances. One laboratory is devoted to the purposes of the department of domestic science; one laboratory, capable of accommodating at a single time 66 students, is assigned to the work in qualitative analysis; a similar laboratory is assigned to the work in physiological chemistry; a small laboratory with convenient supplementary equipment is devoted to the work of the examination of food and drugs for the state inspector; one large laboratory with a convenient and beautifully lighted weighing room is devoted to the work of quantitative analysis; one large laboratory is also devoted to the work in industrial chemistry, and in connection with this laboratory a room for permanent apparatus is provided. The laboratory assigned to physical and electro chemistry is at present divided into two portions, one portion of which is used by the U. S. government for water analysis in connection with the state survey. The work in pharmacy is cared for by means of a large laboratory for pharmacy and a prescription room equipped with all the apparatus ordinarily to be found in the most up-to-date drug establishments. Besides these main laboratories, a large dark room is provided for the work of photo-chemistry.

All of the laboratories throughout the building are equipped with hoods, with forced drafts, water, gas, distilled water, air under pressure and where most needed with hydrogen sulphide and steam. All the hoods, floors and sinks are made of Alberene stone; all table tops and shelvings are made of fir, finished with analine black acid proof paint. All of the plumbing in the building is exposed and is painted with acid proof paint.

CIVIL ENGINEERING

HYDRAULIC. The high pressure equipment consists of one small Tutthill wheel, one Pelton wheel, and various nozzles and orifices connected to a header under a pressure of two hundred and sixty-five feet. For low head experiments and pump tests there is a set of tanks and measuring weirs. Water is furnished for illustrating the flow of water over different forms of weirs, by two centrifugal pumps with a combined capacity of six hundred gallons per minute. Larger weirs are placed in streams near the campus, making it possible for regular work to be conducted under ordinary field conditions. Steam gaugings are carried on both by weir and by current meter, a number of stations having been established where daily readings are taken. A test of an existing plant will be conducted each year, the students being called

upon to take an active part both in the preparation and in the test.

The available equipment includes Price electric and acoustic current meters, difference gauges, test pressure gauges, mercury pressure gauge, hook gauge, water column, and a two-inch venturi meter.

STRUCTURAL MATERIALS. The structural materials testing laboratory contains two 30,000-pound Olsen, one 100,000-pound Riehle, and one 200,000-pound Olsen general testing machines with complete appurtenances for tension, compression and transverse tests under all ordinary conditions, including full-sized beams of timber or reinforced concrete for lengths up to sixteen feet, an impact testing machine, designed by the United States Forest Service, and constructed in the University shops. This has been designed to meet the requirements of a heavy hammer with a low drop. The base weighs seven thousand five hundred pounds; the hammer, with a maximum drop of three feet, may be varied in weight from five hundred to fifteen hundred pounds. It is automatic and autographic, not only for continued drops from the same height, but also for drops from increasing heights. It provides for transverse tests for spans up to five feet as well as for compression and shear. Power saws and a planer are available for preparing timber specimens.

CEMENT. The equipment for testing hydraulic cement is complete for all the ordinary tests as specified by the American Society of Civil Engineers. It contains a Riehle automatic shot testing machine of one thousand pounds capacity; a tempering oven; a boiler for accelerated tests; a Vicat needle apparatus and a set of Gillmore's needles for determining initial and final set; galvanized iron pans, provided with a continuous supply of fresh water for storing briquettes; sieves, moulds, mixing tables, and other necessary accessories.

ROAD. The road laboratory is equipped for testing materials used in the construction of roads. The machines for the abrasion and toughness tests are of the standard designs adopted by the American Society for Testing Materials; other machines are similar to those used by the Office of Public Roads, of the U. S. Department of Agriculture, and complete tests for determining the value of road materials are conducted as specified by that office.

SURVEYING. The equipment consists of one theodolite, with

horizontal circle reading to ten seconds; thirteen engineer's transits; seven levels; and four plane tables together with the necessary compasses, sextants, pocket transits, aneroid barometers, hand levels, chains, rods, etc., for all ordinary plane and topographic surveying.

ELECTRICAL ENGINEERING

The laboratories and lecture rooms are in the south half of the Engineering building, and the equipment may be outlined as follows:

The dynamo laboratory is on the first floor and has a floor space of eighty by one hundred and ten feet. Twenty-six direct current and fourteen alternating current generators and motors are distributed over this room, and wired so as to be readily used for experimental purposes. The machines are of modern design and represent the Westinghouse, General Electric, Bullock, Fort Wayne, and Western Electric manufacture.

The direct current dynamos are wound for one hundred and ten and five hundred volts and of sizes from one to seventy-five kilowatts, with a total rated capacity of two hundred and ninety-five kilowatts. The alternating current machines are single phase, two phase, and three phase, at one hundred and ten and eleven hundred volts, from two up to sixty kilowatts, with a total rated capacity of two hundred and two kilowatts. This includes single phase, two phase, and three phase generators, induction motors with squirrel cage and wound motors, rotary converter, synchronous and repulsion motors. Most of the machines are of five kilowatts capacity, as this size has been found suitable for experimental purposes.

The laboratory is wired so as to separate the dynamos into ten groups, each having a separate switchboard and shaft. These switchboards are so wired that ten pairs of students can work on separate experiments without interfering with each other. A distributing switchboard of twelve panels supplies current to the several section boards. The direct current is distributed at one hundred and ten and five hundred volts, and the alternating, three phase, at ninety, one hundred, one hundred and twenty, one hundred and fifty, two hundred and twenty, two hundred and forty volts. Single phase, from separate generator, is available at one hundred and ten and eleven hundred volts. A storage battery switchboard is also in this room, and receives current from one hundred and thirty storage cells located in the base-

ment. The cells have a normal discharge rating of fifteen amperes for eight hours. By means of knife switches the cells can be arranged in any combination from series to parallel, and by plug connections sent to any section board in the laboratory.

On the first floor are also located five smaller rooms, each about twenty-five by thirty feet, that open directly into the dynamo laboratory. These rooms are used for: (a) instrument making and repairing, (b) grinding room and shop, (c) instrument and stock room, (d) telephone laboratory, (e) electrolysis and special thesis problems.

Besides the storage battery there is a store room and three separate dark rooms for laboratory work in photometry in the basement. A Mathew's photometer is in one of these rooms, and in the other two bench photometers will be placed for work on incandescent and arc lamps.

The laboratories are equipped for the most part with standard Weston and General Electric instruments, while American, Whitney, and Westinghouse makes are also represented. Fourteen indicating direct current portable voltmeters; nine indicating alternating current portable voltmeters; twelve indicating direct current portable ammeters; sixteen indicating alternating current portable ammeters; seven indicating portable wattmeters; nine indicating switchboard voltmeters; eight switch-board ammeters; eight integrating wattmeters; four Bristol recording volt and ammeters.

The power house is used as a commercial laboratory both for operating and testing purposes, and contains the following electrical equipment: (a) a Westinghouse, two-hundred kilowatt, twenty-three-hundred volt, sixty cycle, alternator, direct connected to a reciprocating engine; (b) a Westinghouse, one hundred-kilowatt, twenty-three-hundred volt, sixty cycle, alternator, direct connected to a reciprocating engine; (c) a marble switchboard with modern instruments and appliances.

MECHANICAL ENGINEERING

The mechanical engineering laboratory is conveniently located on the first floor of the Engineering building, adjoining the civil and electrical laboratories. There are available for indicating and testing one two-hundred-and-sixty horse-power engine, and one one-hundred-and-sixty horse-power engine. For experimental purposes there is a thirty horse-power engine, a one-hundred

horse-power engine, a one-hundred-and-ten horsepower engine, of the simple type; a one-hundred horse-power cross-compound engine and a thirty-five horsepower Corliss engine, all of which can be run condensing or non-condensing, arranged to give practice in valve setting speed regulation, indicating and testing. The laboratory is further equipped with a two-stage air compressor, a three-inch centrifugal pump, a surface condenser and jet condenser with air and circulating pumps, indicators, gauges, barometers, thermometers, a pyrometer, Orsat gas apparatus, injector, steam-calorimeters, speed indicators, and brakes. Suitable devices are provided for testing and calibrating the apparatus used. Scales and tanks are arranged for the weighing and measuring of water used. A seven horse-power engine, to burn gas or gasoline, is fitted especially for experiment. In connection with the above are used the two tubulous boilers of the power house. A seven horse-power steam turbine has been installed in such manner that it may be run either with steam under full pressure direct from the boiler or with exhaust from the laboratory engine. In either case the turbine itself may exhaust into the atmosphere or vacuum, several sets of nozzles being available for the various conditions.

The laboratory is also equipped with a locomotive and train air brake outfit, belt testing and oil testing machines, dynamometers, and fuel calorimeters for solid, liquid, and gaseous fuels.

A suction gas producer plant affords opportunity for testing gas producing fuels.

The basement below the first floor provides the best location for condensers, tanks, etc.

The wood-working shop is equipped with lathes and benches, band saws, circular saws with boring attachment, planer, wood trimmer, and the necessary accessories.

The machine shop contains modern high speed lathes with turret attachment, planer, sharper, drill press, a universal milling machine, a universal grinding machine, metal shop saw, emery wheels, and a complete equipment for bench and vise work.

The forge shop is equipped with a power hammer and down draft forges with suitable blower and necessary accessories.

The foundry is provided with a cupola of two tons capacity, a brass melting furnace, core oven, moulding machines, riddles, shakers, cinder mill, rattler, gas furnace and a traveling crane.

The new shop building furnishes adequate quarters for the wood shop, machine shop, forge shop, and foundry.



Coal mine operators of Washington at opening of the Mine Rescue Training Station, March, 1910.

The floor space in this building is approximately thirteen thousand square feet, and is apportioned equally among the various shops.

Fourteen wood-working lathes have been added to an equal number now in the wood shop. Eight new engine lathes have been added to the machine shop equipment. The forge shop is supplied with nineteen down draft forges of the latest design, and one blacksmiths' forge.

GEOLOGY

The geology laboratories, six in number, are in Science hall, four on the first floor, and two occupying the well-lighted basement rooms at the southwest end of the building.

The largest room, fifty by sixty feet, formerly the geological museum, has been fitted up as a laboratory for general geology, physiography and meteorology. It is supplied at present with ten large tables, at which sixty students can work at one time. The laboratory is equipped with working collections of minerals and rocks for each table; forty sets of eighty-five topographic maps for physiographic studies; several complete sets of the United States Geological Survey folios and duplicate sets (forty of each) of a number of the folios for individual study of structural geology. It is also well provided with relief maps, photographs and lantern slides, illustrating the geology and geography of different parts of the United States, and especially of Washington.

A seismograph has been installed in the laboratory for assistance in the study of earthquake phenomena. It is one of the Bosch-Omori type, and is very sensitive, recording distant earthquakes of small intensity.

For the study of meteorology, the department is equipped with the usual weather bureau instruments, barograph, mercurial and aneroid barometers, thermograph, maximum and minimum thermometers, anemometer and tipping-bucket rain-gauge with self-recording apparatus, situated in the laboratory; also numerous charts and maps necessary for the work. Daily records are kept for comparison with other stations.

One of the basement rooms is to be used as a laboratory for map modeling and erosion work in connection with the courses in physiography and general geology. The other room is fitted with lathes, diamond saw, and grinding plates run by electric motor for preparation of rock slides for petrographic study. The

room is supplied with a tile-top table, fitted with gas, for mounting slides.

The petrographical laboratory is on the main floor, adjoining the mineralogy laboratory. It is supplied with a working collection, consisting of a large variety of rock specimens and sets of thin sections of numerous rocks for microscopic examination. There are four petrographical microscopes, with all accessories. Leading from this laboratory is a large dark room well arranged for photographic work.

The mineralogy laboratory, 38 by 45 feet, is situated in the east wing on the first floor of Science Hall. It has been especially designed for mineralogy, and is supplied with eight tables made with tile tops and provided with gas fixtures. These tables accommodate sixty-four students at one time. There are several cabinets filled with collections of minerals for descriptive and determinative work, collections of natural crystals and wood models.

The palaeontology collections are situated in the mineralogy laboratory, and consists of a general palaeontological collection, both of animals and plants from the fossiliferous formation of the state, and the college collection of palaeontology from the Ward Natural Science Establishment, representing all the characteristic invertebrate forms from the Palaeozoic, Mesozoic, and Coenozoic eras.

The other laboratory, adjoining the mineralogy laboratory, formerly used for physiography, is used for the Washington Geological Survey and research library and laboratory. The government reports and geological magazines are kept here, where they can be easily referred to by the students in connection with their other laboratory work.

The department lecture room is on the first floor of Science Hall; has a seating capacity of one hundred and is equipped with models, maps, photographs, and lantern slides, with a lantern and screen for use in class work.

PHYSICS

The laboratories set apart for the use of the department consist of: (1) a general laboratory for students in arts and sciences, (2) a general laboratory for students in applied science, (3) an electrical laboratory, (4) a heat laboratory, (5) a sound and light laboratory, (6) a photometry room, (7) a battery room.

The laboratories are supplied with apparatus from the best American and European makers.

ADMISSION

The requirements for admission to the freshman class of the College of Mines for the courses leading to the degrees of bachelor of science in mining engineering, in geology and mining, or in metallurgical engineering, are as follows:

	<i>Units.</i>
English	4
Algebra	1½
Plane Geometry	1
Solid Geometry.....	½
Physics	1
Chemistry	1
One foreign language	2
History, American preferred	1
or { U. S. History	½
{ Civics	½
Elective	3
Total	15

For course IV, leading to the degree of bachelor of science (B.S.), the entrance requirements are:

	<i>Units.</i>
English	4
Algebra	1½
Plane Geometry	1
Solid Geometry.....	½
Physics	1
One foreign language	2
History, American preferred	1
or { U. S. History	½
{ Civics	½
Elective	4
Total	15

SUMMER WORK

All students in the College of Mines study the operations taking place in two mining districts through the excursions made in the spring. Each student who has reached the end of his junior year makes the trip catalogued as Mining 9. At the end of his senior year he visits a different district while on the trip cata-

logged as Mining 7. In addition to this training, it is necessary for each student to spend several weeks in actual work pertaining to his chosen profession before he enters upon the studies of his senior year. Mining work is elected under courses I and IV, geological field studies or mine mapping under course II, and smelter or assay practice under course III.

DEGREES

The four-year courses in the College of Mines that are numbered I, II and III, are practically unchanged from those of previous years. They lead to the following degrees: Course I, Bachelor of science in mining engineering (B. S. in Min. E.); course II, bachelor of science in geology and mining (B. S. in Geol. and Min.); course III, bachelor of science in metallurgical engineering (B. S. in Met. E.).

In addition to the above, there is offered a new course, IV, which leads to the degree of Bachelor of Science (B. S.). The entrance requirements for course IV are less technical than for the other courses and the training given by it is broader. Students who graduate in this course are advised to spend an additional year in study and research according to the schedule given for the degree of Master of Science in Mining Engineering (M. S. in Min. E.).

The degree of engineer of mines (E. M.) is given to graduates in mining engineering who have practiced their profession for at least three years, and who present a satisfactory thesis. Graduates in metallurgy may receive the degree of metallurgical engineer (Met. E.) under similar conditions.

DEGREE WITH HONORS

A degree with honors may be conferred upon any student who has been recommended by the faculty of the College of Mines.

MINING SOCIETY

The Mining Society, affiliated with the American Institute of Mining Engineers, has a membership composed of upperclassmen, graduate students and three sophomores chosen for the excellence of their records in actual mining. At the monthly meetings of the society addresses are made by prominent mining engineers and papers are given by students as results of their summer's work. The officers for 1910-11 are W. R. Canton, Pres., L. H. Cogswell, Sec., Treas.

COURSES IN THE COLLEGE OF MINES.

I. COURSE IN MINING ENGINEERING

FRESHMAN YEAR

<i>First Semester—</i>		<i>Second Semester—</i>	
	Hours		Hours
Mathematics, 1a (plane trigonometry, higher algebra) ..	4	Mathematics, 2a (Anal. Geom., higher algebra)	4
Chemistry, 1a (general inorganic)	4	Chemistry, 2a (general inorganic)	4
Civil engineering, 1 and 3 (Engin. drawing)	4	Civil Engin., 2 and 4 (Engin. drawing)	4
Rhetoric, 1a (Eng. Comp.) ..	4	Civil Engin., 20 (plane Surv.)	4
Mechanical engineering 1a (woodwork)	2	Mech. Engin., 1b (mine timber)	2
Military science	2	Military science	2
	<hr/> 16+4		<hr/> 16+4

SOPHOMORE YEAR

	Hours		Hours
Geology, 1a (general)	4	Geology, 5 (mineralogy)	4
Mathematics, 3b (Diff. calculus)	4	Mathematics, 4b (calculus) ..	4
Physics, 1a	5	Chemistry, 9 (Quant. Anal.)	4
Civil Engin., 28 (mine surv.)	3	Physics, 2a	5
Military science	2	Military science	2
	<hr/> 16+2		<hr/> 17+2

JUNIOR YEAR

	Hours		Hours
Mining, 4 (coal mining)	2	Mining, 9 (junior excursion)	1
Math., 3a (analytics)	2	Metallurgy, 2 (general)	4
Metallurgy, 1 (fire assaying)	4	Geology, 9 (petrography)	4
Civil Engin., 41 (mechanics)	5	Civil Engin., 50 (hydraulics)	4
Geology, 6 (optical Cryst.) ..	4	Economics, 1	4
Mech. Engin., 3a (forge, foundry)	2		<hr/> 17
	<hr/> 17+2		

Mining practice in summer vacation.

SENIOR YEAR

	Hours		Hours
Mining, 1 (metal mining) ...	4	Mining, 2 (ore dressing)	4
Mining, 3 (milling)	2	Mining Law	1
Mining, 6 (thesis)	1	Mining, 7 (mine examination)	1
Metallurgy, 5 (gold, silver) .	3	Mining, 8 (thesis)	2
Metallurgy, 7 (wet assaying)	3	Geology, 10 (economic)	4
Metallurgy, 13 (design of plant)	3	Geology, 16 (field work)	1
	<hr/> 16	Electrical engineering, 1f.	3
			<hr/> 16

II. COURSE IN GEOLOGY AND MINING

FRESHMAN YEAR

<i>First Semester—</i>		<i>Second Semester—</i>	
	Hours		Hours
Mathematics, 1a (plane Trig., higher algebra)	4	Mathematics, 2a (Anal. Geom., higher algebra)	4
Chemistry, 1a (general inorganic)	4	Chemistry, 2a (general inorganic)	4
Civil Engin., 1 and 3 (Engin. drawing)	4	Civil Engin., 2 and 4 (Engin. drawing)	4
Rhetoric, 1a (English Comp.)	4	Civil Engin., 20 (plane Surv.)	4
Mech. Eng., 1a (woodwork) ..	2	Mech. Engin., 1b (mine timber)	2
Military science	2	Military science	2
	<hr/> 16+4		<hr/> 16+4

SOPHOMORE YEAR

	Hours		Hours
Geology, 1a (general)	4	Geology, 5 (mineralogy)	4
Math., 3b (Diff. calculus) ...	4	Math., 4b (calculus)	4
Physics, 1a	5	Chem., 9 (Quant. Anal.)	4
Civil Engin., 23 (mine Surv.)	3	Physics, 2a	5
Military science	2	Military science	2
	<hr/> 16+2		<hr/> 17+2

JUNIOR YEAR

	Hours		Hours
Mining, 4 (coal mining)	2	Mining, 9 (junior excursion)	1
Metallurgy, 1 (fire assaying)	4	Metallurgy, 2 (general)	4
Metallurgy, 3 (fuels)	2	Metallurgy, 9 (pyrometry) ...	2
Geology, 6 (optical cryst.) ...	4	Metallurgy, 12 (clay testing)	2
Geology, 16 (field work)	1	Geology, 9 (petrography) ...	4
Civil Eng., 23 (Topog. Surv.)	3	Economics, 1	4
Mech. Engin., 3a (forge, foundry)	2		<hr/> 17
	<hr/> 16+2		

Geology or mining practice in summer vacation.

SENIOR YEAR

	Hours		Hours
Mining, 1 (metal mining) ...	4	Mining, 2 (ore dressing)	4
Mining, 6 (thesis)	1	Mining Law	1
Metallurgy, 5 (gold, silver) ..	3	Mining, 7 (mine Exam.)	1
Metallurgy, 7 (wet assaying) .	3	Mining, 8 (thesis)	2
Geology, 11 (paleontology) ..	4	Metallurgy, 4 or 6	3
Geology, 14 (field work)	1	Geology, 10 (economic)	4
	<hr/> 16	Geology, 16 (field work)	1
			<hr/> 16

III. COURSE IN METALLURGICAL ENGINEERING

FRESHMAN YEAR

<i>First Semester—</i>		<i>Second Semester—</i>	
	Hours		Hours
Mathematics, 1a (plane Trig., higher algebra)	4	Mathematics, 2a (Anal. Geom., higher algebra)	4
Chemistry, 1a (general inorganic)	4	Chemistry, 2a (general inorganic)	4
Civil Engin., 1 and 3 (Engin. drawing)	4	Civil Engin., 2 and 4 (Engin. drawing)	4
Rhetoric, 1a (English Comp.)	4	Civil Engin., 20 (plane Surv.)	4
Mech. Eng., 1a (woodwork).	2	Mech. Engin., 1b (mine timber)	2
Military science	2	Military science	2
	<hr/> 16+4		<hr/> 16+4

SOPHOMORE YEAR

	Hours		Hours
Geology, 1a (general).....	4	Geology, 5 (mineralogy)....	4
Math., 3b (Diff. calculus)...	4	Math., 4b (calculus).....	4
Physics, 1a	5	Chem., 9 (Quant. Anal.)....	4
Civil Engin., 28 (mine Surv.)	3	Physics, 2a	5
Military science	2	Military science	2
	<hr/> 16+2		<hr/> 17+2

JUNIOR YEAR

	Hours		Hours
Metallurgy, 1 (fire assaying)	4	Mining, 9 (junior excursion)	1
Metallurgy, 10 (Metallog.)..	3	Metallurgy, 2 (general)....	4
Civil Engin., 41 (mechanics).	5	Metallurgy, 4 (copper, lead).	3
Economics, 1	4	Civil Engin., 42 (mechanics).	4
Mecn. Engin., 3a (forge, foundry)	2	Civil Engin., 50 (hydraulics).	4
	<hr/> 16+2	Mech. Engin., 5b (machine de- sign)	1
		Mech. Engin., 4a (machine work)	2
			<hr/> 17+2

Metallurgical practice in summer vacation.

SENIOR YEAR

	Hours		Hours
Mining, 1 (metal mining)...	4	Mining, 2 (ore dressing)....	4
Mining, 6 (thesis).....	1	Mining, 8 (thesis).....	2
Metallurgy, 3 (fuels).	2	Mining, 7 (mine Exam.)....	1
Metallurgy, 5 (gold, silver)..	3	Metallurgy, 6 (minor metals)	2
Metallurgy, 7 (wet assaying).	3	Metallurgy, 8 (analysis)....	3
Metallurgy, 11 (problems)...	1	Geology, 10 (economic).....	4
Metallurgy, 13 (design)....	3		<hr/> 16
	<hr/> 17		

IV. COURSE IN MINING ENGINEERING

Leading to degree of Bachelor of Science (B. S.)

FRESHMAN YEAR

<i>First Semester—</i>		<i>Second Semester—</i>	
	Hours		Hours
Mathematics, 1a (plane Trig., higher algebra)	4	Mathematics, 2a (Anal. Geom., higher algebra)	4
Chemistry, 1 (general).....	4	Chemistry, 2 (general).....	4
Rhetoric, 1a (English Comp.)	4	Civil Engn., 1 and 3 (Engin. drawing)	4
Modern foreign language....	4	Modern foreign language....	4
Mech. Engn., 1a (woodwork) ..	2	Mech. Eng., 1b (mine timber)	2
Military science	2	Military science	2
	<hr/> 16+4		<hr/> 16+4

SOPHOMORE YEAR

	Hours		Hours
Mathematics, 3a (calculus)..	4	Mathematics, 4a (calculus)..	4
Chemistry, 8b (Qual. Anal.)...	4	Physics, 1a	5
Civil Engn., 2 and 4 (Engin. drawing)	4	Chemistry, 9 (Quant. Anal.)..	4
Modern foreign language....	4	Civil Eng., 20 (surveying)..	4
Mech. Engn., 3a (forge, foundry)	2	Military science	2
Military science	2		<hr/> 17+2
	<hr/> 16+4		

JUNIOR YEAR

	Hours		Hours
Mathematics, 5a (calculus)..	2	Mining, 9 (junior excursion)..	1
Physics, 2a	6	Metallurgy, 1 (fire assaying)	4
Geology, 1a	4	Elec. Engn., 1f.....	3
Civil Engn., 28 (mine Surv.)	3	Civil Engn., 41 (mechanics)	5
Mining, 5 (field work).....	1	Geology, 5 (mineralogy)....	4
	<hr/> 16		<hr/> 17

Mining practice in summer vacation.

SENIOR YEAR

	Hours		Hours
Metallurgy, 2 (general).....	4	Mining, 2 (ore dressing)....	4
Mining, 1 (mining).....	4	Mining, 7 (mine Exam.).....	1
Civil Engn., 42 (mechanics)..	4	Metallurgy, 8 (metal Anal.)..	2
Geology, 6 (optical Cryst.)...	4	Geology, 9 (petrography)....	4
	<hr/> 16	Geology, 16 (field wor...)....	1
		Economics, 1	4
			<hr/> 16

GRADUATE COURSE IN MINING ENGINEERING.

Following course IV and leading to the degree of master of science in mining engineering.

<i>First Semester—</i>		<i>Second Semester—</i>	
	Hours		Hours
Mining, 10 (mining methods)..	3	Mining, 4 (coal mining).....	4
Mining, 5 (thesis).....	1	Mining, 6 (mining law).....	1
Metallurgy, 7 (wet assay)....	3	Mining, 7 (mine Exam.).....	1
Metallurgy, 4 (copper, lead)..	3	Mining, 8 (thesis).....	3
Metallurgy, 13 (design).....	3	Geology, 10 (economic).....	4
Elective, engineering	3	Elective, engineering	3
	<hr/> 16		<hr/> 16



Squad in mine surveying.

V. SHORT SESSION FOR MINING MEN

The 15th annual Short Session for mining men will open on January 4th, 1912, continuing until April 1st. During that period each year nine of the instructors in mining engineering offer a course for the benefit of persons who are interested in prospecting, mining or metal-working. Admission to the classes is without examination. Instruction is given by lectures, laboratory exercises, and visits to mines and plants in operation. The past experience and future aims of each student are taken into consideration, and the character of his work arranged accordingly.

No preparation is needed for this course. Many practical men with an interest in some branch of mining but without much education have obtained satisfactory results from the course; others with a college education and mining experience have gained much up-to-date training and information. In 1911 the number of students was 28, their ages varying from 20 to 53 years. During the first week of the course the instruction is of a general nature. Thereafter the students select those courses which best fit their needs. It is expected that a student will elect only those courses that he can attend with considerable regularity. Practically all the students attend the following subjects: evening lectures, mining, field trips, mineralogy, geology, mining law; in addition to these subjects, fire assaying and general chemistry are taken by many of the quartz miners, while the placer men substitute placer mining and surveying. Subject 3 cannot be taken without subjects 5 and 6. A few students each year attend only one or two subjects. Students who satisfactorily complete a course of study are given a certificate stating the amount and character of work done. For students who return a second year, a special course is arranged in continuation of their previous work.

The advantages of the University laboratories and libraries are open to all. Students may board and room at the dormitories or elsewhere, as preferred. Occasional trips are made to the Tacoma and Everett smelters, the United States assay office in Seattle, the coal and metal mines and the hydro-electric plants near Seattle. Tests of ore are made in the complete concentrating and stamp milling laboratory. Miners and prospectors who have ore samples to be assayed or tested by mill-run may perform their

own tests with the assistance of the professors in charge, as soon as the necessary skill has been attained.

There are no charges, except for material used. Deposits are made to cover the actual cost of supplies drawn by each student, the balance of the deposit being returned at the end of the course. All deposits are made at the beginning of the course.

SUBJECTS

A. MINERAL INDUSTRY. Tuesday evenings in February and March, 8:00 p.m. A series of lectures illustrated by lantern slides, showing views of the mining and metallurgical industries, with details of machinery and processes. Faculty and special lecturers.

1. MINING. Lectures on prospecting, development, mining systems, timbering, mine transportation, pumping, ventilation, and hydraulic mining. Practice with stamp-milling and concentrating machinery, testing of ores, etc. *Two lectures and one afternoon a week.* Professor ROBERTS.

2. FIELD TRIPS. An outline study of the operations at neighboring mines, mills, and smelters; geological field studies, followed by laboratory practice on the rocks and minerals found. *Saturdays.* Professors ROBERTS and DANIELS.

3. FIRE ASSAYING. Lectures on sampling, preparing ores for assay, furnaces, fuels, reagents, and the fire assay of gold, silver, lead, and tin ores. The laboratory work includes the testing of reagents, and the assaying of various ores. *One lecture and three afternoons a week in laboratory.* Deposit, fifteen dollars. Mr. COREY.

4. METALLURGY. A study of the principles of metallurgy for the benefit of those who are engaged in the metal trades or in the mining of ores requiring smelter treatment. *Two lectures and one afternoon a week.* Deposit, five dollars. Mr. COREY.

5. GENERAL CHEMISTRY AND QUALITATIVE ANALYSIS. Laboratory practice in the determination of the common elements. *Three lectures a week, and Saturday laboratory.* Deposit, ten dollars. Professor BENSON.

6. MINERALOGY. Instruction and practice in blowpipe analysis, with lectures upon the common minerals, and practice in the identification of minerals by field tests. *Twice a week.* Deposit, two dollars. Dr. WEAVER.

7. GEOLOGY. Lectures on the elements of geology, the common varieties of rock, metalliferous vein and ore deposits, etc. *Twice a week.* Dr. WEAVER.

8. MINING LAW. A series of lectures on the mining laws of the United States and Alaska. Illustrated by drawings and mine maps. *Once a week.* Professor CONDON, Mr. SHAMEL.

9. SURVEYING. Instruction and field practice in the use of simple instruments for making underground and surface surveys; the elements of drawing, lettering, sketch-mapping and field notes; the rules governing mineral surveys. *Two lectures and two afternoons a week.* Mr. GLEASON.

10. FORGE. Practice in sharpening and tempering drill steel and picks; systematic training in the making and care of fires, and the application of various heats, drawing, punching, riveting, bending, twisting, upsetting, welding iron and steel, and making and tempering machine tools. Deposit, two dollars. *One afternoon a week.* Mr. KANE.

11. PLACER MINING. The elements of hydraulics; the flow of water in pipes, flumes and ditches; the methods and costs of placer mining in its various forms. *Three lectures a week.* Professor McCAUSTLAND.

12. COAL MINING AND RESCUE TRAINING. For a description of the short courses in coal mining, first aid to the injured and rescue training, see under "Mine Rescue Training Station," page State Mine Inspector BOTTING and Government Engineers.

DEPARTMENTS OF INSTRUCTION.

MINING ENGINEERING AND METALLURGY

MILNOR ROBERTS, *Professor*;JOSEPH DANIELS, *Assistant Professor*;CLARENCE RAYMOND COREY, *Instructor*;GEORGE JAMME, HARVEY L. GLENN, and ROGER TAYLOR, *Lecturers*;EDWARD H. DENNY, *Assistant in Metallurgy*;JAMES M. McDONALD, *Assistant in Mining*.

MINING ENGINEERING

For a description of the courses offered to the short session students during January, February and March, see the preceding three pages.

Coal miners who are taking the ten-days' course in the Mine Rescue Training Station are given daily instruction and laboratory demonstrations in the subjects of mine gases, ventilation, the origin and composition of coals, and coal analysis.

A. MINERAL INDUSTRY. *Second semester.* A series of lectures illustrated by stereopticon views. Tuesday evenings in February and March, 8:00 p. m. An outline of the mining and metallurgical industries of the Pacific Northwest and Alaska, illustrated by views of mines, mills and smelters.

Professor ROBERTS and special lecturers.

1. MINING. *First semester. Four hours.* Three lectures and one laboratory period. Lectures on sinking, tunneling, stoping, timbering, systems of mining, power generation, air compression, hoisting, transportation, drilling, explosives, and cost keeping. Practice in machine drilling, ventilation, air compression, and the designing of mine equipment. Regular course of training under U. S. Bureau of Mines in first aid to the injured and in use of oxygen helmets. Prerequisite, senior standing.

Professor ROBERTS.

2. ORE DRESSING. *Second semester. Four hours.* Two lectures and two laboratory periods. A detailed study of certain branches of ore dressing with laboratory practice in the same, followed by the complete test of assigned ores by millruns checked by sampling and assaying. Prerequisite, Mining 3. Senior or graduate subject.

Professor ROBERTS and Mr. McDONALD.

3. **MILLING.** *First semester. Two hours.* One lecture and one laboratory period. Lectures on the principles of ore dressing. Mill practice in breaking ores by hand and machinery, crushing by stamps, rolls and grinders, screen-sizing, classifying, panning, amalgamation, concentration by jigs, vannels, Overstrom, New Standard, Wilfley and revolving slime tables, and magnetic concentration.

Professor ROBERTS and Mr. McDONALD.

4. **COAL MINING.** *First semester. Two hours.* Coal mining methods, lighting, ventilation, haulage, and all phases of the mining and preparation of coal for the market, with especial reference to the geological structure of the coal fields of the Pacific coast and the local methods of mining. A complete study of the Renton coal mine.

Professors ROBERTS and DANIELS and Mr. JAMME.

5. **FIELD WORK.** *First semester. One hour.* One laboratory period (or its equivalent in total time required) and monthly seminar. Class or individual visits to a mine, mill, smelter, or engineering work, to be followed by a report on field notes and sketches.

Professors ROBERTS and DANIELS.

6. **THESIS OUTLINE.** *First semester. One hour.* The outlining of the senior thesis, the gathering of material, study of references, making of drawings, maps, etc., in preparation for the work of the second semester. See mining 8. Senior or graduate.

Professors ROBERTS and DANIELS and Mr. COREY.

7. **MINE EXAMINATION.** *Second semester. One hour.* Ten days in the second semester. An excursion of the senior class to a mine or mining district for the purpose of studying mine equipment, methods and economic conditions, and for practice in mine sampling and estimation of ore.

Professors ROBERTS and DANIELS and Mr. COREY.

8. **THESIS.** *Second semester. Two hours.* A continuation of Mining 6. Weekly consultation.

Professors ROBERTS and DANIELS and Mr. COREY.

9. **JUNIOR EXCURSION.** *Second semester. One hour.* An excursion of the junior class to a mine or mining district. Sometimes made in connection with the senior excursion, Mining 7, in which case a given district will not be visited two years in succession. Required for senior standing.

Professors ROBERTS and DANIELS and Mr. COREY.

10. MINING METHODS. *First semester. Three hours. Two lectures and one laboratory period. A detailed study of certain branches of mining. Senior or graduate. Professor ROBERTS.*

METALLURGY

1. FIRE ASSAYING. *First semester. One lecture and three laboratory periods. The testing of reagents, the crushing, sampling, and assaying of ores, furnace and mill products for lead, silver, gold and tin; also, the assay of base and dore bullion. Prerequisite, chemistry 9. Deposit, fifteen dollars.*

Messrs. COREY and GLENN.

2. GENERAL METALLURGY. *Second semester. Two lectures and two laboratory periods. Lectures and laboratory experiments on the properties of metals and alloys, fuels, refractory materials, furnaces and the extraction of the common metals from their ores. Visits to smelter. Prerequisites, geology 5, chemistry 9, metallurgy 1. Deposit, ten dollars.*

Professor ROBERTS, Messrs. COREY and TAYLOR.

3. METALLURGICAL FUELS. *First semester. Three hours. One lecture and two laboratory periods. The composition and metallurgical uses of natural and artificial fuels; the methods and costs of coking in beehive and by-product ovens, gas making, and coal briquetting. Furnace and calorimeter tests of various types of fuels; especially the testing of Washington coals to determine their fitness for coking, gas making, power purposes, etc. Deposit, five dollars.*

Professor DANIELS.

4. COPPER AND LEAD. *Second semester. Three hours. Two lectures and one laboratory period. Lectures and recitations on the metallurgy of copper, including roasting of ores and matte, smelting in blast and reverberatory furnaces, converting of matte and refining of copper by furnace and electrolytic methods; the metallurgy of lead, roasting, pot roasting and smelting of lead ores, lead refining by Parks, Pattinson and Betts processes. Laboratory practice in roasting copper and lead ores and mattes, smelting and refining in reverberatory furnace, and electrolytic refining. Visits to lead and copper smelters and refineries. Deposit, five dollars.*

Mr. COREY.

5. GOLD AND SILVER. *First semester. Three hours. Two lectures and one laboratory period. Amalgamation, cyaniding, and*

chlorination of gold and silver ores. Complete tests checked by assays. Deposit, five dollars. Mr. COREY.

6. MINOR METALS. *Second semester. Three hours.* Two lectures and one laboratory period. The metallurgy of zinc, antimony, tin, mercury, nickel, etc.; a study of the plant required, the methods and costs of treatment, and the economic conditions governing the production of the minor metals. Laboratory experiments on ores and furnace products. Deposit, five dollars. Mr. COREY.

7. WET ASSAYING. *First semester. Three hours.* The technical methods for the determination of copper, lead, zinc, etc., in ores and furnace products, etc. Prerequisite, chemistry 9. Deposit, ten dollars. Mr. COREY.

8. METALLURGICAL ANALYSIS. *Second semester. Three hours.* Laboratory practice in technical methods of analysis of coals, slags, and industrial products. Prerequisite, chemistry 9. Deposit, ten dollars. Mr. COREY.

9. PYROMETRY AND ALLOYS. *Second semester. Two hours.* One lecture and one laboratory period. Methods of measuring high temperatures. Union of metals by fusion, compression and electro-deposition; solution of metals in metals; the behavior of metals and alloys under heat; liquation and cooling curves; the rarer metals and their alloys. Laboratory practice in thermal measurements, synthesis and testing of alloys. Deposit, three dollars. Mr. COREY.

10. METALLOGRAPHY. *First semester. Two hours.* One lecture and laboratory period. The constitution and microstructure of metals and alloys, especially iron and steel. The preparation and study of metal sections, photo-micrography and the use of the microscope to aid in testing structural iron and steel. Students in this course have the privilege of using the extensive collections of metal sections in the Seattle city testing laboratory. Deposit, three dollars. Professor ROBERTS and Mr. COREY.

11. METALLURGICAL PROBLEMS. *First semester. One hour.* Physical chemistry for the metallurgist, slag calculations, etc., illustrated by figures quoted from the present practice at a number of smelting plants. Prerequisites, chemistry 9, and metallurgy 2. Mr. COREY.

12. CLAY TESTING. *Second semester. Three hours.* One lecture and two laboratory periods. Methods of testing clays, refractory materials, cement making materials. Designed especially to determine the industrial value of crude materials found in Washington. Deposit, three dollars. Mr. COREY.

13. DESIGN OF PLANT. *First semester. Three hours.* Three drafting periods. The designing of a piece of equipment or a structure for mining, milling or metallurgical purposes. Problems with all conditions and requirements stated are given to the student for solution in the drafting room. Numerous blue prints and photographs of plants and equipment are on file for reference. Senior or graduate.

Professors ROBERTS and DANIELS.

THESIS. See mining 6 and 8.

SUMMER FIELD WORK. See mining 7 and 9.

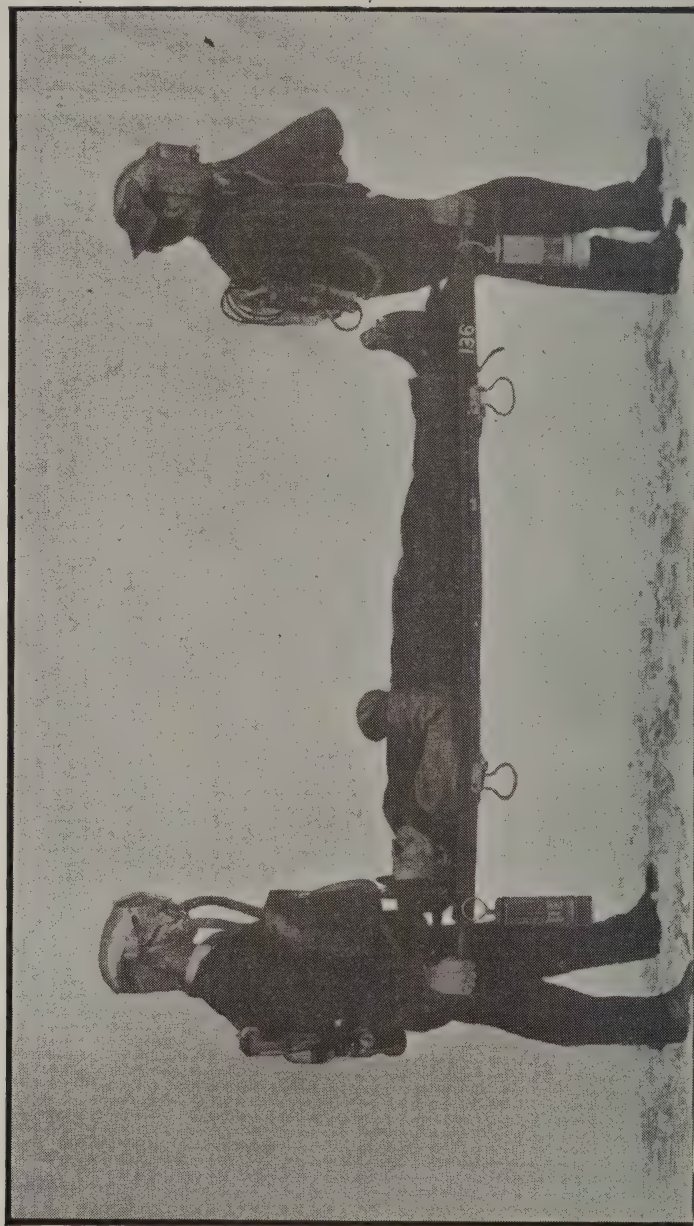
CHEMISTRY.

1, 2. GENERAL CHEMISTRY. *Four hours.* Many students come from accredited schools in which chemistry is not required. To meet the needs of such students, a course is offered consisting of two lectures and six hours laboratory work per week. Text-books, Smith's College Chemistry and Laboratory Manual. Deposit ten dollars per semester.

Professor BYERS, Instructors and Assistants.

1a, 2a. GENERAL CHEMISTRY. *Four hours.* This course is designed primarily for engineers, but is open to all students who have had a year's work in chemistry in an accredited high school. It consists of two lectures and six laboratory hours per week. At least one of these laboratory hours will be devoted to quiz work upon the subject-matter of the lectures. The text-books used are Smith's General Chemistry, Smith's Laboratory Manual and Byers and Knight's Qualitative Analysis. Deposit ten dollars per semester. Professor BYERS, Dr. TRUMBULL and Assistants.

1b. GENERAL CHEMISTRY. *Second semester. Four hours.* To meet the need of students coming from high schools at the beginning of the second semester, the course 1a, 2a is repeated, beginning the second semester. Strong students or those carrying light course will be permitted to elect this course without the prerequisite high school course; but to satisfy the required work of



[2 men with stretchers] First aid to the injured.

the engineering course, such students must elect some other four-hour course in the department of chemistry. Deposit ten dollars per semester. Dr. ROSE.

2b. GENERAL CHEMISTRY. *First semester. Four hours.* Continuation of 1b of second semester. Deposit ten dollars per semester. Dr. ROSE.

1c, 2c. GENERAL CHEMISTRY. *Four hours.* A course in inorganic chemistry for students of domestic science and women of the College of Arts and Sciences. This course consists of two lectures and six laboratory hours per week. General chemistry will be taken up in the lectures during the first semester and analytical during the second semester. The laboratory work will consist in part of qualitative and quantitative analysis. Text-books to be selected. Deposit ten dollars per semester. Dr. ROSE.

1d. PROSPECTOR'S COURSE. *Four hours.* To meet the demand, a special course in chemistry will be given to miners who may enter January 1, and will continue to April 1. It will not require any previous knowledge of chemistry, and will be merged into a course of qualitative analysis. The text-book required is Brownlee. Deposit ten dollars per semester.

Associate Professor BENSON.

9. QUANTITATIVE ANALYSIS. *Each semester. Four hours.* Gravimetric and volumetric analysis. Olsen's Quantitative Analysis. Twelve laboratory hours and one recitation per week. Deposit ten dollars per semester. Associate Professor BENSON.

ENGLISH

1, 2. ENGLISH COMPOSITION. *Four hours, throughout the year.* A study of the principles of rhetoric, with abundant practice in theme writing and some consideration of modern English prose. Every member of the class will be required to meet his instructor at stated times to confer on his work. Given in fourteen sections. Course 1 will be repeated the second semester.

GEOLOGY

1a. GENERAL GEOLOGY. *First semester. Four hours.* A semester's course for engineering students. Lectures, recitations and laboratory work. Laboratory fee \$1. Professor LANDES.

5. MINERALOGY. *Second semester. Four hours.* Two laboratory periods. Descriptive and determinative mineralogy. Practice in the determination of unlabeled minerals by means of their physical properties and by blow-pipe analysis. Laboratory fee of \$2.
Dr. WEAVER.

6. OPTICAL CRYSTALLOGRAPHY. *First semester. Four hours.* Chemical and optical properties of crystallized matter. Demonstrations of the different methods of investigation of the rock-forming minerals in thin sections under the microscope. Use of the polarizing microscope and preparation of thin sections. Laboratory fee of \$2.
Dr. WEAVER.

9. PETROGRAPHY. *Second semester. Four hours.* Principles and methods of investigation of rock-forming substances. A study of the distinguishing characteristics of the different groups and species of rocks with practice in their determination by modern petrographical methods. Preparation of thin sections. Prerequisite: 1a, or 1, or 4, 5, 6.
Dr WEAVER.

10. ECONOMIC GEOLOGY. *Second semester. Four hours.* A study of the origin and extent of metalliferous veins and ore deposits; varieties of coal, extent and locations of coal fields; gas and oil; origin, occurrences, and uses of clays; building and ornamental stones; minor mineral products of use in the arts and of commercial importance. Prerequisites: 1 and 2, or 1a, 5, 9.
Professor LANDES.

11, 12. PALEONTOLOGY. *Four hours.* The general principles of the study of fossil organisms, with their geologic and geographic distribution. A laboratory study of the most important forms of fossil invertebrates. Excursions in the field in the vicinity of Puget sound. Prerequisites: 1 and 2, or 1a.
Dr. WEAVER.

15, 16. FIELD WORK. Credits and time to be arranged for arts students. One hour or eight days in second semester for mining engineers. Instruction and practice in methods of field observation, mapping and interpretation of results. A study of special problems presented by the structural, physiographic and petrographic conditions in the Puget sound basin with occasional extended excursions. Prerequisites: 1 and 2, 1a, or 4 and 5.
Professors LANDES, SAUNDERS, and Dr. WEAVER.

B. PROSPECTORS' GEOLOGY AND MINERALOGY. Lectures, recitations, and laboratory work in general geology and mineralogy. This course is given in January, February, and March, to the students in the short course for mining men. Dr. WEAVER.

PHYSICS

1a. MECHANICS AND WAVE MOTION. *First semester. Four hours.* This course must be accompanied by 1b.

Professor OSBORN, and Dr. GRONDAHL.

2a. LIGHT, HEAT, ELECTRICITY *Second semester. Four hours.* This course must be accompanied by 2b.

Professor OSBORN and Dr. GRONDAHL.

POLITICAL AND SOCIAL SCIENCE

1. ELEMENTS OF ECONOMICS. *Both semesters. Four hours.* An introductory study of the economic laws governing the production, distribution, and exchange of wealth; and some of their more important applications, such as the tariff, labor unions, trusts, etc.

Assistant Professor CUSTIS, Mr. BENNETT, and ———.

ZOOLOGY

13. EVOLUTION. *Second semester. Two hours.* A series of lectures upon the more important biological problems related to the general theory of organic evolution, including variation, selection, mutation and heredity. Illustrated by stereopticon views. Prerequisite. Zoology 1, botany 1, or their equivalent.

Professor KINCAID.

CIVIL ENGINEERING

1, 2. ENGINEERING DRAWING. *One hour.* Linear drawing, including exercises in irregular curves and section lining; Roman and Gothic capital letters; a system of freehand lettering for working drawings. Prerequisite, plane geometry.

Assistant Professor HARRIS and ———.

3, 4. ENGINEERING DRAWING. *Each semester. Three hours.* The elements of descriptive geometry, including orthographic projection, rotation of points, lines and planes, intersection of surfaces, warped surfaces and principles of shades, shadows and

perspective. Prerequisites, solid geometry, preceded or accompanied by drawing 1 and 2.

Assistant Professor HARRIS, Professor McCaustland, Mr. Gleason, Mr. Muehlstein and Mr.——.

20. PLANE SURVEYING. *Each semester. Theory of chain, compass, and transit surveying, leveling, the adjustment and use of instruments, methods used in the United States public land surveys, computations of area, maps. Prerequisites: Drawing 1 and mathematics 1a.* Mr. GLEASON and Assistants.

23. TOPOGRAPHIC SURVEYING. *First semester. Three hours. Base line measurement. Reading, adjusting and computing triangulation systems. Methods of making topographic and hydrographic surveys, including phototopography and cartography. Prerequisites: Surveying 21, mathematics 4b.* Mr. MILLER.

28. MINING SURVEYING. *Each semester. Three hours. Field adjustments of the transit and level. Use of the mining clinometer and other instruments designed primarily for mining work. Methods of carrying a meridian underground and underground practice. Maps and records. The surface surveying in this course includes the surveying of mineral claims for patent, borehole surveys and a brief introduction to topographic work. The topographic work includes plane triangulation, base line measurement and photographic surveying. Prerequisite, surveying 20.* Mr. ——.

41, 42. MECHANICS. *41 each semester, five hours. 42 each semester, four hours. Statics, dynamics and mechanics of materials. Solution of problems by graphic and analytic methods. Recitations and computations. Prerequisites: Mathematics 4b, physics 1a.* Associate Professor MORE, and Mr. ADLER.

50 HYDRAULICS. *Second semester. Flow of water through pipes and orifices, over weirs and in open channels; energy, impulse and reaction of jets with application to impulse wheels. A brief review of hydrostatics is given at the beginning of the semester. This course must be preceded or accompanied by 42.*

Assistant Professor HARRIS.

ELECTRICAL ENGINEERING

6. ELECTRICAL ENGINEERING. *Second semester. Three hours. This course deals with the application of electricity to mining and is arranged for students in mining engineering.*

Mr. MALLOY.

MECHANICAL ENGINEERING

1. CARPENTRY AND WOOD-TURNING. One four-hour exercise a week, each semester. The student receives training in the use and care of wood-working tools. Instruction and practice is given in sawing, planing, chiseling, champfering, grooving, framing, tenoning, mortising, dovetailing, splicing, gluing. Exercises in turning include consideration of speeds, use of gouges, chisels, nosing tools, side tools, parting tools, and calipers. Mr. BEATTIE.

2. PATTERN MAKING AND CABINET WORK. One four-hour exercise a week, each semester. Same schedule as 1. The pattern making includes the construction of core boxes, and such patterns as pipe fitting, valves, pulleys, and machine parts. This is followed by a series of exercises in cabinet work embracing the application to more difficult and advanced work of the principles previously given. Mining engineers are given practice in framing of mine timbers, working from drawings and blue prints.

Mr. BEATTIE.

3. FORGE AND FOUNDRY. One four-hour exercise a week each semester. The student is given systematic training in the making and care of fires, and the application of various heats, drawing, punching, riveting, bending, twisting, upsetting, welding iron and steel, and making and tempering machine tools. In the foundry the student is given work in iron and brass; bench and floor moulding, core-making, and is instructed with the view toward proficiency in management of the cupola.

Mr. KANE.

4. MACHINE WORK. One four-hour exercise a week each semester. The course begins with exercises in chipping, filing, and scraping. These are followed by work on the lathe in both iron and brass, including straight and taper turning, centering, chucking, screw cutting, boring, drilling and tapping, knurling and polishing. A few exercises on other machines are given.

Mr. KANE.

10a. MACHINE DESIGN. *Each semester. One hour. First five weeks.* For students taking mining engineering, an abridgement of 10.

Mr. _____.

REGISTER OF STUDENTS

COLLEGE OF MINES.

ABBREVIATIONS

CLASSES

'11 Senior
'12 Junior
'13 Sophomore

'14 Freshman
Sp. Special Student
S. C. Short Course Student

*Name of Student and Rank**Home Address*

Armstrong, Gilbert Seymour, '14.....	Seattle
Awoki, Monroe Tetsigi, '12.....	Ogaki, Japan
Baumann, Henry N., Jr., '11.....	Seattle
Berg, J. Edward, '13.....	Orillia
Bergman, Rynard, '14.....	Chelan
Bissell, Robert Wilson, '12.....	Pittsburg, Pa.
Bisson, Francis, Jr., '13.....	South Prairie
Bridgeman, Eathan Allen, Jr., '13.....	Seattle
Burgert, Wilbur Clarence, '13.....	Seattle
Canton, William Reynolds, '11.....	Waterville
Carr, Delbert Earl, '12.....	Portland, Ore.
Clark, George William, '14.....	Sedro Woolley
Cogswell, Louis Harold, '12.....	Seattle
Cole, Henry Ambrose, '12.....	Seattle
Cole, Robert Joseph, '14.....	Seattle
Covington, Claude W., '14.....	Seattle
Crary, Horace H., '12.....	Canistota, N. Y.
Crone, Homer B., '12.....	Seattle
Darnell, John Monroe, '12.....	Denver, Colo.
Davis, LeRoy Jefferson, '12.....	Seattle
Dennis, Gail, '14.....	Seattle
Denny, Edward Harold, '11.....	Seattle
Denton, Pierre E., '14.....	Tacoma
Diether, Louis Meyer, '12.....	Seattle
Dobson, Chris G., '13.....	Seattle
Drylie, Thomas Frame, '14.....	Issaquah
Dunbar, Walter Clifford, '11.....	Grandview
Fotheringham, Thomas Humber, '14.....	Seattle
Gleason, Villeroy, '14.....	Seattle
Halferdahl, Arthur, '13.....	Seattle

Hallock, George Oakley, '12.....	Seattle
Hazelet, Calvin Cheever, '14.....	Cordova, Alaska
Heuss, Edward Charles, '11.....	Seattle
Hill, Frank Ablest, Jr., '14.....	Seattle
Hoffstrom, E. C., '14.....	Seattle
Huber, Dale Galloway, '14.....	Seattle
Hurd, Charles Sumner, '14.....	Mt. Vernon
Jenkins, Albert Charles, '12.....	Seattle
Johnson, Donald Grover, '14.....	Seattle
Johnson, Guy Jonas, '12.....	Spokane
Johnson, John Dow, '14.....	Valparaiso, Ind.
Lemon, Ralph Charles, '14.....	Centralia
Lewis, Clinton R., '12.....	Georgetown
Lockwood, Everett Wellington, '12.....	Waterville
McDonald, James Michael, '12.....	Seattle
McKay, William O., '13.....	Seattle
McKinley, David A., '13.....	Spokane
McPhee, Alexander John, '11.....	Spokane
Meany, George Edward, '13.....	Colfax
Murphy, Joseph Gratton, '14.....	Seattle
Nelson, Victor, '14.....	Seattle
Nicholson, Stuart Henry, '14.....	Big Lumber, Mont.
Peters, James Raymond, '13.....	Seattle
Phipps, Claude Edgerton, '14.....	Seattle
Pike, Roscoe Warner, '14.....	Seattle
Porter, Fred S., '14.....	Seattle
Presley, BeVan, '14.....	Seattle
Putnam, Guy Leland, '14.....	Seattle
Roberts, George Franklin, '12.....	Seattle
Roberts, Mason Henry, '13.....	Portland, Ore.
Ross, Will A., '13.....	Portland, Ore.
Sanderson, Thomas A., '13.....	Seattle
Searing, Oliver P., '12.....	Jacksonville, Fla.
Smith, Warren S., '12.....	Berlin
Spenger, Fred Jacob, '14.....	Bellingham
Swarva, George Lewis, '11.....	Seattle
Sweeney, Edward Lavary, '14.....	Tacoma
Thomason, Errol Llewellyn, '12.....	Seattle
Waterhouse, Robert Dakin, '14.....	Waterville
Welch, George B., '13.....	Muskego, Wis.
Westover, Ralph, '14.....	Seattle

Will, Edward Clark, '14.....	Seattle
Wilson, Alfred S., '13.....	Seattle
Wright, Lawrence B., '14.....	Snohomish

UNCLASSIFIED.

Antisell, Toner, S. C.....	Seattle
Batz, Johanna, S. C.....	Rawhide, Nev.
Collins, Frank Elmer, S. C.....	Salmo, B. C.
Cornwall, William, S. C.....	Index
Derrig, Patrick Edward, S. C.....	Valdez, Alaska
Dunlap, Daniel D., S. C.....	Bremerton
Fenton, F. M., S. C.....	Oakland, Calif.
Goodell, Luther Trowbridge, Sp.....	Seattle
Hall, William C., S. C.....	Seattle
Harris, Thomas Daniel, S. C.....	Breckenridge, Colo.
Jagerson, Frank E., S. C.....	Seattle
Jones, Walter Scott, S. C.....	Albany, N. Y.
Latimer, William Kenneth, S. C.....	Gordon Head, B. C.
Long, Leon Dudley, Sp.....	Seattle
McCoy, Fred, S. C.....	Seattle
Marshall, Spalding A., Sp.....	Spokane
Nasmyth, J. H., S. C.....	Sumner
Norris, William Lee, S. C.....	Seattle
Owen, Evan J., S. C.....	Seattle
Robinson, Kenneth Sargent, S. C.....	Seattle
Scott, O. P., S. C.....	Seattle
Sherman, Sidney, S. C.....	Seattle
Tatro, Clarence Alfred, S. C.....	Seattle
Vogel, Edward, S. C.....	Riga, Russia
Wickstrom, Carl, S. C.....	Ballard
Witherill, John Ray, S. C.....	Seattle
Youngs, Lockwood G., S. C.....	Seward, Alaska

The following have received certificates from the Mine Rescue Training Station at Seattle, Washington, and have attended lectures given by Dean Roberts, of the School of Mines:

Louis J. Cross.....	Coal Miner.....	Renton, Wn.....	S. E. Co.
J. B. Delaurenti....	Coal Miner.....	Renton, Wn.....	S. E. Co.
W. H. Berringer....	Mine Foreman....	Bayne, Wn.....	U. C. Co.
C. F. Helffinger....	Fire Boss.....	Taylor, Wn.....	D. R. C. & C.
M. A. Morgan.....	Fire Boss.....	Ravensdale, Wn....	N. W. I. Co.
F. F. Dahl.....	Mine Foreman....	Blk. Diamond, Wn..	P. C. C. Co.
E. McGilley.....	Mine Foreman....	Cle Elum, Wn.....	N. W. I. Co.
Geo. Morris.....	Haulage Foreman..	Roslyn, Wn.....	N. W. I. Co.
M. Walters.....	Mine Foreman....	Taylor, Wn.....	D-R.C.C.Co.
Thos. Day.....	Fire Boss.....	Ravensdale, Wn....	N. W. I. Co.
Geo. Williams.....	Fire Boss.....	Carbonado, Wn.....	C. H. C. Co.
Wm. C. Shaw.....	Fire Boss.....	Roslyn, Wn.....	R. F. Co.
Chas. McKowan....	Coal Miner.....	Renton, Wn.....	S. E. Co.
David Lunden.....	Fire Boss.....	Blk. Diamond, Wn..	P. C. C. Co.
Ed. Richards.....	Fire Boss.....	Roslyn, Wn.....	N. W. I. Co.
A. G. Lindsay.....	Haulage Foreman..	Roslyn, Wn.....	N. W. I. Co.
T. S. Wallace.....	Haulage Foreman..	Roslyn, Wn.....	R. F. Co.
Rob't Price.....	Mine Foreman....	Carbonado, Wn....	C. H. C. Co.
Thos. Morgan.....	Mine Inspector....	Nanaimo, B. C.....	
Evan Evans.....	Mine Inspector....	Cranbrook, B. C...	
John Newton.....	Mine Inspector....	Cumberland, B. C...	
Rob't Strachan....	Mine Inspector....	Hosmer, B. C.....	
J. J. Corey.....	Rescue Foreman....	Seattle, Wn.....	B. of M.
J. M. Anderson....	Rescue Foreman....	Billings, Mont.....	B. of M.
R. C. McClary.....	Coal Miner.....	Seattle, Wn.....	
E. H. Sutor.....	Coal Miner.....		
David Taylor.....	Coal Miner.....	Nanaimo, B. C.....	
A. Talford.....	Coal Miner.....	Billings, Mont.....	
James Hardman....	Coal Miner.....	Kopiah, Wn.....	
D. J. Thomas.....	Fire Boss.....	Burnett, Wn.....	Pac. C. C. Co.

U. OF W. STUDENTS (MINING)

L. H. Cogswell	Geo. Swarva
H. H. Crary	D. E. Carr
E. L. Thomason	A. C. Halferdahl
F. G. Roberts	J. E. Berg
O. R. Searing	L. T. Goodell
J. C. Dobson	

SUMMARY OF ENROLLMENT

BY COLLEGES AND SCHOOLS

Graduate School	65
College of Arts and Sciences	1,245
College of Engineering	392
Chemical Engineering	25
Civil Engineering	192
Electrical Engineering	126
Mechanical Engineering	49
College of Forestry	87
School of Law	206
College of Mines	76
College of Pharmacy	71
Foresters' Short Course (Three-months' Course).....	31
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	<hr/>
	2,200

BY CLASSES

Graduate Students	65
Seniors	188
Juniors	324
Sophomores	512
Freshmen	801
Unclassified, Arts and Sciences	152
Unclassified, Engineering	23
Unclassified, Forestry	39
Unclassified, Law	45
Unclassified, Mining	27
Unclassified, Pharmacy	24
	<hr/>
	2,200
Summer Session of 1910	303
	<hr/>
	2,503
Deduct Summer Students now attending University.....	76
	<hr/>
Net total for the year	2,427

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The Bulletin of the UNIVERSITY OF
WASHINGTON Includes the following
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“ “ “ Engineering

“ “ “ Forestry

“ School of Law

“ College of Mines

“ “ “ Pharmacy

“ Graduate School

“ Summer Session

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UNIVERSITY OF ILLINOIS
BULLETIN

PRESIDENT'S OFFICE

University of Washington

SERIES I

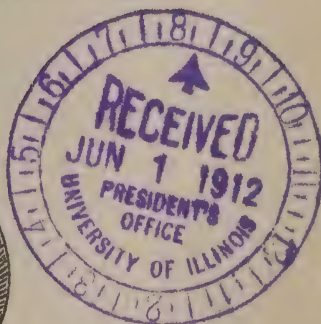
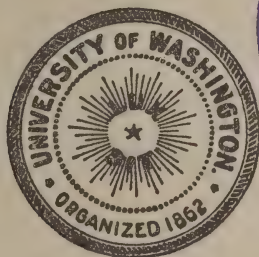
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No. 59—PART 7

COLLEGE OF MINES

1911—1912

UNIVERSITY OF ILLINOIS
FEB 1 1921



SEATTLE, WASHINGTON

Published Quarterly by the University

1912

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UNIVERSITY OF ILLINOIS

PRESIDENT'S OFFICE

COLLEGE OF MINES

INDEX

(Mines section)

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UNIVERSITY CALENDAR

1911-12

Campus day	May 10
Junior day	May 18
Memorial day (holiday).....	May 30
Semester examinations close.....	June 7
Baccalaureate Sunday	June 9
President's reception	June 10
Alumni day	June 11
Commencement	June 12

SUMMER SESSION

Registration day	June 24
Recitations begin	June 25
Session closes	Aug. 2

1912-13

FIRST SEMESTER

Examinations for admission....	Friday and Saturday, Sept. 13, 14
Registration days.....	Monday, Tuesday, Sept. 16, 17
Recitations begin.....	Wednesday, Sept. 18
Thanksgiving vacation.....	{ Wednesday, Nov. 27, 6 p. m., to Monday, Dec. 2, 8 a. m.
Christmas vacation.....	{ Friday, Dec. 20, 6 p. m., to Monday, Jan. 6, 8 a. m.
Semester examinations. }	Monday, Tuesday, Wednesday, Thurs- day, Friday, Jan. 27, 28, 29, 30, 31.

SECOND SEMESTER

Registration day.....	Monday, Feb. 3
Recitations begin.....	Tuesday, Feb. 4
Washington's birthday (holiday).....	Saturday, Feb. 22
Spring vacation.....	{ Friday, April 4, 6 p. m., to Monday, April 14, 8 a. m.
Campus day.....	Friday, May 2
Junior day.....	Saturday, May 10
Memorial day (holiday).....	Friday, May 30
Semester examinations.....	Monday, June 9, to Friday, June 13
Baccalaureate Sunday.....	June 15
President's reception.....	Monday, June 15
Alumni day.....	Tuesday, June 17
Commencement.....	Wednesday, June 18

THE BOARD OF REGENTS

HON. JOHN C. HIGGINS, President, term expires 1914.....Seattle
HON. CHAS. P. SPOONER, term expires 1914.....Seattle
HON. HOWARD G. COSGROVE, term expires 1915.....Seattle
HON. JOHN A. REA, term expires 1916.....Tacoma
HON. A. L. ROGERS, term expires 1916.....Waterville
HON. F. A. HAZELTINE, term expires 1917.....South Bend
HON. ALEX. F. McEWAN, term expires 1917.....Seattle

WILLIAM MARKHAM, Secretary of the Board.

ADMINISTRATIVE OFFICERS

THE UNIVERSITY

THOMAS FRANKLIN KANE, PH. D., LL. D., President.
HERBERT T. CONDON, LL. B., Bursar and Secretary of the Faculty.
EDWARD N. STONE, A. M., Recorder.
EDWIN B. STEVENS, A. M., Secretary to the President.
ISABELLA AUSTIN, A. B., Dean of Women.

THE SCHOOLS AND COLLEGES

ARTHUR SEWALL HAGGETT, PH. D., Dean of the College of Arts and Sciences, Administration Building and Denny Hall.
ALMON HOMER FULLER, M. S., C. E., Dean of College of Engineering, Engineering Building.
MILNOR ROBERTS, A. B., Dean of the College of Mines, Mines Building.
CHARLES WILLIS JOHNSON, PH. C., PH. D., Dean of the College of Pharmacy, Bagley Hall.
JOHN THOMAS CONDON, LL. M., Dean of the School of Law, Law Building.
FRANCIS GARNER MILLER, M. F., Dean of the College of Forestry, Forestry Building.
J. ALLEN SMITH, PH. D., Dean of the Graduate School, Denny Hall.

THE LIBRARY

WILLIAM E. HENRY, A. M., Librarian, Library Building.

COLLEGE OF MINES.

FACULTY

- THOMAS FRANKLIN KANE, Ph. D., Johns Hopkins, President.
MILNOR ROBERTS, A. B., Stanford, Professor of Mining Engineering and Metallurgy, Dean.
HENRY LANDES, A. M., Harvard, Professor of Geology and Mineralogy.
ALMON HOMER FULLER, M. S., C. E., Lafayette, Professor of Civil Engineering.
JOHN THOMAS CONDON, L. L. M., Northwestern, Professor of Law.
HORACE BYERS, Ph. D., Johns Hopkins, Professor of Chemistry.
TREVOR KINCAID, A. M., Washington, Professor of Zoology.
FREDERICK ARTHUR OSBORN, Ph. D., Michigan, Professor of Physics.
ROBERT EDOUARD MORITZ, Ph. N. D., Strassburg, Professor of Mathematics and Astronomy.
*CARL EDWARD MAGNUSSON, Ph. D., E. E., Wisconsin, Professor of Electrical Engineering.
EVERETT OWEN EASTWOOD, C. E., A. M., Virginia, Professor of Mechanical Engineering.
D. C. HALL, Ph. B., M. D., Sc. M., Chicago, Professor of Physical Training.
E. J. McCAUSTLAND, B. C. E., M. C. E., Cornell, Professor of Civil Engineering.
*CHARLES CHURCH MORE, M. S., C. E., Lafayette, Associate Professor of Civil Engineering.
HENRY KREITZER BENSON, Ph. D., Columbia, Associate Professor of Chemistry.
JOSEPH DANIELS, S. B., M. S., Lehigh, Assistant Professor of Mining Engineering and Metallurgy.
VANDERVEER CUSTIS, Ph. D., Harvard, Assistant Professor of Economics.
*FRANK MARION MORRISON, A. B., Michigan, Assistant Professor of Mathematics.
LOREN DOUGLAS MILLIMAN, A. B., Michigan, Assistant Professor of English.
GEORGE SAMUEL WILSON, B. S., Nebraska, Assistant Professor of Mechanical Engineering.
CHARLES M. HARRIS, C. E., Cornell, Assistant Professor of Civil Engineering.
E. A. LOEW, B. S., Wisconsin, Assistant Professor of Electrical Engineering.
JAMES EDWARD GOULD, Ph. B., A. M., Harvard, Assistant Professor of Mathematics.
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*Absent on leave during 1911-12.

CLARENCE RAYMOND COREY, E. M., Montana, Instructor in Mining Engineering and Metallurgy.
 *HENRY LOUIS BRAKEL, A. M., Washington, Instructor in Physics.
 FRANK EDWARD JOHNSON, E. E., Minnesota, Instructor in Electrical Engineering.
 GEORGE IRVING GAVETT, B. S., C. E., Assistant Professor in Mathematics.
 WILLIAM VERNON LOVITT, A. M., Instructor in Mathematics.
 CHARLES EDWARD WEAVER, Ph. D., Instructor in Geology.
 JOHN W. MILLER, B. S., Instructor in Civil Engineering.
 JULIUS ADLER, B. S., Instructor in Civil Engineering.
 CHARLES EDWARD NEWTON, E. M., Instructor in Civil Engineering.
 SAMUEL THOMAS BEATTIE, Instructor in Woodwork.
 WARREN S. SMITH, Assistant in Metallurgy.
 JAMES M. McDONALD, Assistant in Mining.
 GEO. B. WELCH, Assistant in Stock Room.
 GEORGE JAMME, Lecturer on Coal Mining.
 HARVEY L. GLENN, B. S., Lecturer on Assaying of Bullion.
 ROGER TAYLOR, B. S., Lecturer on Copper Smelting.
 C. H. SHAMEL, LL. B., Ph. D., Lecturer on Mining Law.
 GEORGE BATES HARRINGTON, S. B., Mass. Inst. Tech., Lecturer on the Economics of Mining.
 DAVID C. BOTTING, State Coal Mine Inspector, Lecturer on Mine Regulations.

ADMISSION TO THE FRESHMAN CLASS

To be admitted to the freshman class, students must either (a) pass an examination based on a four-year course amounting in the aggregate to fifteen units, or (b) complete a course of the same length in an accredited school.

The requirements for admission to the freshman class of the College of Mines for curricula I, II and III, leading to the degrees of bachelor of science in mining engineering, in geology and mining, or in metallurgical engineering, are as follows:

	Units
†English	4
Algebra	1½
Plane geometry	1
Solid geometry	½
Physics	1
Chemistry	1
One foreign language	2
History, American preferred.....	1
Or United States history, ½; civics, ½.	
Elective	3
Total.....	15

*Absent on leave during 1911-12.

†A student presenting four units of foreign language may be admitted with three instead of four units of English.

For course IV, leading to the degree of bachelor of science (B.S.), the entrance requirements are:

	Units
†English	4
Algebra	1½
Plane geometry	1
Solid geometry	½
Physics	1
One foreign language	2
History, American preferred.....	1
Or United States history, ½; civics, ½.	
Elective	4
Total.....	15

DEGREES

The four-year courses in the College of Mines lead to the following degrees: Course I, bachelor of science in mining engineering (B.S. in Min. E.); course II, bachelor of science in geology and mining (B.S. in Geol. and Min.); course III, bachelor of science in metallurgical engineering (B.S. in Met. E.).

In addition to the above, course IV, which leads to the degree of bachelor of science (B.S.), is offered. The entrance requirements for course IV are less technical than for the other courses and the training given by it is broader. Students who graduate in this course are advised to spend an additional year in study and research according to the schedule given for the degree of master of science in mining engineering (M.S. in Min. E.). A new course in coal mining engineering is offered, beginning in September, 1912.

The degree of engineer of mines (E.M.) is given to graduates in mining engineering who have practiced their profession for at least three years, and who present a satisfactory thesis. Graduates in metallurgy may receive the degree of metallurgical engineer (Met. E.) under similar conditions.

MINING AND METALLURGICAL INDUSTRIES AVAILABLE FOR STUDY

Excellent opportunities for becoming familiar with mining and metallurgical operations are open to students in the College of Mines. The amount of time available during the college year for this purpose is not great and even by using the summer vacations it is impossible for a student to cover the whole field of local industries included in his chosen profession.

Mining machinery of the best types is in operation within easy reach of the University. Much of the heavy mining machinery used in the neighboring states and Alaska is built in the city of Seattle, while the patented machines, such as drills and concentrating tables of all makes are kept in stock and as working exhibits by the firms that supply the North Pacific coast regions. The application of hydraulic mining methods to city grading is

being carried on locally on a very large scale and with the most approved pumping and piping appliances and methods. Equally important to the mining engineer are the operations of the steam shovels, which are used largely now in iron, copper and gold mining. The engineers in charge of these plants have given the mining students every opportunity to become familiar with the methods of planning and carrying on the work, and the same statement applies to the mine operators throughout the state.

A brief list of the other available works of interest includes coal mines, with the largest production west of the Rocky mountains; metal mines of gold, silver, copper, arsenic, antimony, iron, etc.; cement plants, glass works, several stone quarries and dressing works; clay mines, clay and pottery works; gravel and sand pits with large production and approved methods; a region of varied geology with many economic minerals; the Tacoma and Everett smelters and refineries; the U. S. assay office; the Iron-dale steel plant of the Western Steel Corporation, and several plants engaged in metallurgical work.

MINING SOCIETY

The Mining Society, affiliated with the American Institute of Mining Engineers, has a membership composed of upperclassmen, graduate students and three sophomores, chosen for the excellence of their records in actual mining. At the monthly meetings of the society addresses are made by prominent mining engineers, and papers descriptive of their summer work are presented by the student members. The officers for 1911-12 are, Horace H. Crary, president; Geo. B. Welch, vice-president; Clinton R. Lewis, secretary-treasurer.

UNITED STATES MINE RESCUE TRAINING STATION

The United States Mine Rescue Training Station, operated in connection with the College of Mines, occupies a separate building. The "smokeroom," fitted with track and car, overcast airway, doghole, and smudge floors, is the largest of its kind in the country, measuring 25 by 50 feet.

Several sets of the Draeger oxygen apparatus and pulmotor are kept on hand for practice as well as for use in mine rescue work. The purpose of the station is to train miners in the use of oxygen helmets, which are used in cases of mine fires and explosions in both coal and metal mines. From ten days to two weeks' time is required for the course of training. The applicant is taught the construction of the apparatus and is required to wear it for four hours each day, in two periods of two hours each. The practice is carried on in a room filled with gas which cannot be breathed without immediate danger, and the work to be performed is the same as that which would be required in actual mining operations or rescue work. The smokeroom represents a portion of a mine, and is equipped with mine car, track, overcast, timbers and brick. Applicants who have completed the course of training receive a certificate from the U. S. Bureau of Mines.

INSTRUCTION FOR COAL MINING MEN

Miners taking the rescue training also receive instruction in the College of Mines on the subjects of mine gases, explosions, and the origin and distribution of Pacific Coast and Alaska coals. Laboratory experiments are carried on to show the methods of analyzing coals and determining the uses to which they may be put. The methods of testing for permissible explosives at the Pittsburgh Station and the safe methods of charging, tamping and firing are explained. Special lectures are given by State Mine Inspector Botting, Assistant Inspector Corey and government engineers.

CURRICULA IN THE COLLEGE OF MINES

I. CURRICULUM IN MINING ENGINEERING

For men intending to enter coal mining, a new curriculum in coal mining engineering is offered. The freshman and sophomore years will be as now scheduled for course I. The junior and senior studies will be given beginning with the fall of 1912. Announcement will be made in June, 1912.

FRESHMAN YEAR

Sem. 1: Mathematics 1a, Cr. 4; chemistry 1a, Cr. 4; civil engineering 1, 3, Cr. 6; English 1a, Cr. 2; mechanical engineering 1, Cr. 2; drill, Cr. 2. Total credits, 16+4.

Sem. 2: Mathematics 2a, Cr. 4; chemistry 2a, Cr. 4; civil engineering 4, Cr. 2; civil engineering 20, Cr. 4; mechanical engineering 9, Cr. 2; English 1b, Cr. 2; drill, Cr. 2. Total credits, 16+4.

SOPHOMORE YEAR

Sem. 1: Geology 1a, Cr. 4; mathematics 3a, Cr. 4; physics 1a, Cr. 4; physics 1b, Cr. 2; civil engineering 28, Cr. 3; drill, Cr. 2. Total credits, 17+2.

Sem. 2: Geology 9, Cr. 4; mathematics 4a, Cr. 4; chemistry 9, Cr. 4; physics 2a, Cr. 4; physics 2b, Cr. 2; drill, Cr. 2. Total credits, 18+2.

JUNIOR YEAR

Sem. 1: Mining 4, Cr. 2; mathematics 5a, Cr. 2; metallurgy 1, Cr. 4; civil engineering 41, Cr. 5; geology 13, Cr. 4; mechanical engineering 3, Cr. 2. Total credits, 17+2.

Sem. 2: Mining 9, Cr. 1; metallurgy 2, Cr. 4; geology 16, Cr. 4; civil engineering 50, Cr. 4; economics 1, Cr. 4. Total credits, 17. Mining practice in summer vacation.

SENIOR YEAR

Sem. 1: Mining 1, Cr. 4; mining 3, Cr. 2; mining 6, Cr. 1; metallurgy 5, Cr. 3; metallurgy 7, Cr. 3; metallurgy 13, Cr. 3. Total credits, 16.

Sem. 2: Mining 2, Cr. 4; mining law, Cr. 1; mining 7, Cr. 1; mining 8, Cr. 2; geology 17, Cr. 4; geology 20, Cr. 1; electrical engineering 6, Cr. 3. Total credits, 16.

II. CURRICULUM IN GEOLOGY AND MINING

FRESHMAN YEAR

Sem. 1: Mathematics 1a, Cr. 4; chemistry 1a, Cr. 4; civil engineering 1, 3, Cr. 6; English 1a, Cr. 2; mechanical engineering I, Cr. 2; drill, Cr. 2. Total credits, 16+4.

Sem. 2: Mathematics 2a, Cr. 4; chemistry 2a, Cr. 4; civil engineering 4, Cr. 2; civil engineering 20, Cr. 4; English 1b, Cr. 2; mechanical engineering 9, Cr. 2; drill, Cr. 2. Total credits, 16+4.

SOPHOMORE YEAR

Sem. 1: Geology 1, Cr. 4; mathematics 3a, Cr. 4; physics 1a, Cr. 4; physics 1b, Cr. 2; civil engineering 28, Cr. 3; drill, Cr. 2. Total credits, 17+2.

Sem. 2: Geology 9, Cr. 4; mathematics 4a, Cr. 4; chemistry 9, Cr. 4; physics 2a, Cr. 4; physics 2b, Cr. 2; drill, Cr. 2. Total credits, 17+2.

JUNIOR YEAR

Sem. 1: Mining 4, Cr. 2; metallurgy 1, Cr. 4; metallurgy 3, Cr. 2; geology 13, Cr. 4; geology 16, Cr. 1; civil engineering 23, Cr. 3; mechanical engineering 3, Cr. 2. Total credits, 16+2.

Sem. 2: Mining 9, Cr. 1; metallurgy 2, Cr. 4; metallurgy 9, Cr. 2; metallurgy 12, Cr. 2; geology 16, Cr. 4; economics 1, Cr. 4. Total credits, 17. Geology or mining practice in summer vacation.

SENIOR YEAR

Sem. 1: Mining 1, Cr. 4; mining 6, Cr. 1; metallurgy 5, Cr. 3; metallurgy 7, Cr. 3; geology 18, Cr. 4; geology 14, Cr. 1. Total credits, 16.

Sem. 2: Mining 2, Cr. 4; mining law, Cr. 1; mining 7, Cr. 1; mining 8, Cr. 2; metallurgy 4 or 6, Cr. 3; geology 17, Cr. 4; geology 20, Cr. 1. Total credits, 16.

III. CURRICULUM IN METALLURGICAL ENGINEERING

FRESHMAN YEAR

Sem. 1: Mathematics 1, Cr. 4; chemistry 1a, Cr. 4; civil engineering 1, 3, Cr. 6; English 1a, Cr. 2; mechanical engineering 1, Cr. 2; drill, Cr. 2. Total credits, 16+4.

Sem. 2: Mathematics 2a, Cr. 4; chemistry 2a, Cr. 4; civil engineering 4, Cr. 2; civil engineering 20, Cr. 4; English 1b, Cr. 2; mechanical engineering 9, Cr. 2; drill, Cr. 2. Total credits, 16+4.

SOPHOMORE YEAR

Sem. 1: Geology 1a, Cr. 4; mathematics 3a, Cr. 4; physics 1a, Cr. 4; physics 1b, Cr. 2; civil engineering 28, Cr. 3; drill, Cr. 2. Total credits, 17+2.

Sem. 2: Geology 9, Cr. 4; mathematics 4, Cr. 4; chemistry 9, Cr. 4; physics 2a, Cr. 4; physics 2b, Cr. 2; drill, Cr. 2. Total credits, 18+2.

JUNIOR YEAR

Sem. 1: Metallurgy 1, Cr. 4; metallurgy 10, Cr. 3; civil engineering 41, Cr. 5; economics 1, Cr. 4; mechanical engineering 3, Cr. 2. Total credits, 16+2.

Sem. 2: Mining 9, Cr. 1; metallurgy 2, Cr. 4; metallurgy 4, Cr. 3; civil engineering 42, Cr. 4; civil engineering 50, Cr. 4; mechanical engineering 5b, Cr. 1; mechanical engineering 4a, Cr. 2. Total credits, 17+2. Metallurgical practice in summer vacation.

SENIOR YEAR

Sem. 1: Mining 1, Cr. 4; mining 6, Cr. 1; metallurgy 3, Cr. 2; metallurgy 5, Cr. 3; metallurgy 7, Cr. 3; metallurgy 11, Cr. 1; metallurgy 13, Cr. 3. Total credits, 17.

Sem. 2: Mining 2, Cr. 4; mining 8, Cr. 2; mining 7, Cr. 1; metallurgy 6, Cr. 2; metallurgy 8, Cr. 3; geology 17, Cr. 4. Total credits, 16.

IV. CURRICULUM IN MINING ENGINEERING

Leading to the degree of bachelor of science.

FRESHMAN YEAR

Sem. 1: Mathematics 1a, Cr. 4; chemistry 1, Cr. 4; English 1a, Cr. 2; modern foreign language, Cr. 4; mechanical engineering 1, Cr. 2; civil engineering 1, Cr. 2; drill, Cr. 2. Total credits, 16+4.

Sem. 2: Mathematics 2a, Cr. 4; chemistry 2, Cr. 4; civil engineering 3, Cr. 4; modern foreign language, Cr. 4; mechanical engineering 9, Cr. 2; drill, Cr. 2. Total credits, 16+4.

SOPHOMORE YEAR

Sem. 1: Mathematics 3a, Cr. 4; chemistry 8b, Cr. 4; civil engineering 4, Cr. 2; modern foreign language, Cr. 4; mechanical engineering 3, Cr. 2; English 1b, Cr. 2; drill, Cr. 2. Total credits, 16+4.

Sem. 2: Mathematics 4a, Cr. 4; physics 1a, Cr. 4; physics 1b, Cr. 2; chemistry 9, Cr. 4; civil engineering 20, Cr. 4; drill, Cr. 2. Total credits, 18+2.

JUNIOR YEAR

Sem. 1: Mathematics 5a, Cr. 2; physics 2a, Cr. 4; physics 2b, Cr. 2; geology 1a, Cr. 4; civil engineering 28, Cr. 3; mining 5, Cr. 1. Total credits, 17.

Sem. 2: Mining 9, Cr. 1; metallurgy 1, Cr. 4; electrical engineering 6, Cr. 3; civil engineering 41, Cr. 5; geology 9, Cr. 4. Total credits, 17. Mining practice in summer vacation.

SENIOR YEAR

Sem. 1: Metallurgy 2, Cr. 4; mining 1, Cr. 4; civil engineering 42, Cr. 4; geology 13, Cr. 4. Total credits, 16.

Sem. 2: Mining 2, Cr. 4; mining 7, Cr. 1; metallurgy 8, Cr. 2; geology 16, Cr. 4; geology 20, Cr. 1; economics 1, Cr. 4. Total credits, 16.

GRADUATE COURSE IN MINING ENGINEERING

Following course IV and leading to the degree of master of science in mining engineering.

Sem. 1: Mining 10, Cr. 3; mining 5, Cr. 1; metallurgy 7, Cr. 3; metallurgy 4, Cr. 3; metallurgy 13, Cr. 3; elective, engineering, Cr. 3. Total credits, 16.

Sem. 2: Mining 4, Cr. 2; mining 6, Cr. 1; mining 7, Cr. 1; mining 8, Cr. 3; geology 17, Cr. 4; elective, engineering, Cr. 3; mining 11, Cr. 2. Total credits, 16.

V. SHORT SESSION FOR MINING MEN

The sixteenth annual Short Session for mining men will open on January 8th, 1913, continuing until April 4th. During that period each year twelve of the instructors in mining engineering offer a course for the benefit of persons who are interested in prospecting, mining, smelting, clay or metal-working. Admission to the classes is without examination. Instruction is given by lectures, laboratory exercises, and visits to mines and plants in operation. The past experience and future aims of each student are taken into consideration, and the character of his work arranged accordingly.

No preparation is needed for this course. Many practical men with an interest in some branch of mining but without much education have obtained satisfactory results from the course; others with a college education and mining experience have gained much up-to-date training and information. Practically all the students attend the following subjects: Mining, field trips, mineralogy, geology, mining law; in addition to these subjects, fire assaying and general chemistry are taken by many of the quartz miners, while the placer men substitute placer mining and surveying. Subject 3 cannot be taken without subjects 5 and 6. Students who satisfactorily complete a course of study are given a certificate stating the amount and character of work done. For students who return a second year, a special course is arranged in continuation of their previous work.

The advantages of the University laboratories and libraries are open to all. Students may board and room at the dormitories or elsewhere, as preferred. There are no charges, except for material used. Deposits are made to cover the actual cost of supplies drawn by each student, the balance of the deposit being returned at the end of the course. All deposits are made at the beginning of the course.

SUBJECTS

A. MINERAL INDUSTRY. Tuesday evenings in February and March, 8:00 p.m. A series of lectures illustrated by lantern slides, showing views of the mining and metallurgical industries, with details of machinery and processes. Faculty and special lecturers.

1. MINING. Lectures on prospecting, development, mining systems, timbering, mine transportation, pumping, ventilation,

and hydraulic mining. Practice with stamp-milling and concentrating machinery, testing of ores, etc. Two lectures and one afternoon a week.
Professor ROBERTS

2. FIELD TRIPS. An outline study of the operations at neighboring mines, mills, and smelters; geological field studies, followed by laboratory practice on the rocks and minerals found. Saturdays.
Professors ROBERTS and DANIELS

3. FIRE ASSAYING. Lectures on sampling, preparing ores for assay, furnaces, fuels, reagents, and the fire assay of gold, silver, lead, and tin ores. The laboratory work includes the testing of reagents, and the assaying of various ores. One lecture and three afternoons a week in laboratory. Deposit, fifteen dollars.
Mr. COREY

4. METALLURGY. A study of the principles of metallurgy for the benefit of those who are engaged in the metal trades or in the mining of ores requiring smelter treatment. Two lectures and one afternoon a week. Deposit, five dollars.
Mr. COREY

5. GENERAL CHEMISTRY AND QUALITATIVE ANALYSIS. Laboratory practice in the determination of the common elements. Three lectures a week, and Saturday laboratory. Deposit, ten dollars.
Professor BENSON

6. MINERALOGY. Instruction and practice in blowpipe analysis, with lectures upon the common minerals, and practice in the identification of minerals by field tests. Twice a week. Deposit, two dollars.
Dr. WEAVER

7. GEOLOGY. Lectures on the elements of geology, the common varieties of rock, metalliferous vein and ore deposits, etc. Twice a week.
Dr. WEAVER

8. MINING LAW. A series of lectures on the mining laws of the United States and Alaska. Illustrated by drawings and mine maps. Once a week.
Professor CONDON, Mr. SHAMEL

9. SURVEYING. Instruction and field practice in the use of simple instruments for making underground and surface surveys; the elements of drawing, lettering, sketch-mapping and field notes; the rules governing mineral surveys. Two lectures and two afternoons a week.
Mr. NEWTON

10. FORGE. Practice in sharpening and tempering drill steel and picks; systematic training in the making and care of fires, and the application of various heats, drawing, punching, riveting, bending, twisting, upsetting, welding iron and steel, and making and tempering machine tools. Deposit, two dollars. One afternoon a week.
Mr. KANE

11. MINE TIMBER FRAMING. Shop work in the cutting, framing and erecting of various types of timbers employed in mining operations. Deposit, two dollars. One afternoon a week.
Mr. BEATTIE

12. **PLACER MINING.** The elements of hydraulics; the flow of water in pipes, flumes and ditches; the methods and costs of placer mining in its various forms. Three lectures a week.

Professor McCaustland

COAL MINING AND RESCUE TRAINING. For a description of the short courses in coal mining, first aid to the injured and rescue training, see under "Mine Rescue Training Station," page 172.

Professor DANIELS, State Mine Inspector BOTTING and Government Engineers.

DEPARTMENTS OF INSTRUCTION

MINING ENGINEERING AND METALLURGY

PROFESSOR MILNOR ROBERTS, ASSISTANT PROFESSOR JOSEPH DANIELS, INSTRUCTOR CLARENCE RAYMOND COREY; LECTURERS, GEORGE JAMME, HARVEY L. GLENN, ROGER TAYLOR; ASSISTANT IN METALLURGY, WARREN S. SMITH; ASSISTANT IN MINING, JAMES M. McDONALD; ASSISTANT IN STOCK ROOM, GEO. B. WELCH.

MINING ENGINEERING

Coal miners who are taking the ten days' course in the U. S. Mine Rescue Training Station are given daily instruction and laboratory demonstrations in the subjects of mine gases, ventilation, the origin and composition of coals, and coal analysis.

1. **MINING.** Sem. 1, Cr. 4. Three lectures and one laboratory period. Lectures on mining, power generation, air compression, hoisting and transportation. Practice with air compressors, machine drills and mine equipment in laboratories and local plants. Prerequisite: Senior standing. Professor ROBERTS

2. **ORE DRESSING.** Sem. 2 Cr. 4. Two lectures and two laboratory periods. A detailed study of certain branches of ore dressing followed by a full test of ores by mill run checked by assays. Prerequisite: Mining 3. Senior or graduate.

Professors ROBERTS and DANIELS, and Mr. McDONALD

3. **MILLING.** Sem. 1, Cr. 2. One lecture and one laboratory period. Lectures and mill practice in the principles of ore dressing. Professors ROBERTS and DANIELS, and Mr. McDONALD

4. **COAL MINING.** Sem. 1, Cr. 2. The preparation of coal for market; the coal fields of the Pacific Coast; a study of the Renton coal mine. Regular course of training under U. S. Bureau of Mines in rescue work and first aid to the injured.

Professors ROBERTS and DANIELS

5. **FIELD WORK.** Sem. 1, Cr. 1. One laboratory period (or its equivalent in total time required) and monthly seminar. Class

or individual visits to a mine, mill, smelter, or engineering work, to be followed by a report on field notes and sketches.

Professors ROBERTS and DANIELS

6. **THESIS OUTLINE.** Sem. 1, Cr. 1. The outlining of the senior thesis, the gathering of material, study of references, making of drawings, maps, etc., in preparation for the work of the second semester. See mining 8. Senior or graduate.

Professors ROBERTS and DANIELS, and Mr. COREY

7. **MINE INSPECTION.** Sem. 1, Cr. 1. Ten days in the second semester. An excursion of the senior class to a mine or mining district. Professors ROBERTS and DANIELS, and Mr. COREY

8. **THESIS.** Sem. 2, Cr. 2. A continuation of mining 6. Weekly consultation and seminars.

Professors ROBERTS and DANIELS, and Mr. COREY

9. **JUNIOR EXCURSION.** Sem. 2, Cr. 1. An excursion of the junior class to a mine or mining district. Sometimes made in connection with the senior excursion, mining 7. Required for senior standing.

Professors ROBERTS and DANIELS, and Mr. COREY

10. **MINING METHODS.** Sem. 1, Cr. 3. Two lectures and one laboratory period. A detailed study of certain branches of mining. Senior or graduate.

Professor ROBERTS

11. **MINE MANAGEMENT.** Sem. 1, Cr. 2. Two lectures. A study of the organization and administration of engineering plants, involving the keeping and interpretation of cost accounts, the efficiency of labor and methods, the financial, legal and social aspects of engineering operation.

Professor DANIELS

METALLURGY

1. **FIRE ASSAYING.** Sem. 1. One lecture and three laboratory periods. The testing of reagents, the crushing, sampling and assaying of ores, furnace and mill products for lead, silver, gold and tin; also, the assay of base and dore bullion. Prerequisite: Chemistry 9. Deposit, fifteen dollars.

Messrs. COREY, GLENN and SMITH

2. **GENERAL METALLURGY.** Sem. 2. Two lectures and two laboratory periods. The properties of metals and alloys, fuels, refractory materials, furnaces and the extraction of the common metals from their ores. Visits to smelter. Deposit, ten dollars.

Professor ROBERTS, Messrs. COREY and TAYLOR

3. **METALLURGICAL FUELS.** Sem. 1, Cr. 2. One lecture and one laboratory period. The composition, manufacture and metallurgical uses of natural and prepared fuels; the methods and costs of coking, gas making, and coal briquetting. Furnace and calorimeter tests of various types of fuels. Deposit, five dollars.

Professor DANIELS

4. **COPPER AND LEAD.** Sem. 2, Cr. 3. Three lectures. The metallurgy of copper and lead, especially the methods of roasting, smelting and refining.

Mr. COREY

5. GOLD AND SILVER. Sem. 1, Cr. 3. Two lectures and one laboratory period. Amalgamation, cyaniding, and chlorination of gold and silver ores. Complete tests checked by assays. Deposit, five dollars. Mr. COREY

6. MINOR METALS. Sem. 2, Cr. 3. Two lectures and one laboratory period. The metallurgy of zinc, antimony, tin, mercury, nickel, etc.; a study of the plant required, the methods and costs of treatment. Deposit, five dollars. Mr. COREY

7. WET ASSAYING. Sem. 1, Cr. 3. Technical methods for the determination of copper, lead, zinc, etc., in ores and furnace products, etc. Prerequisite: Chemistry 9. Deposit, ten dollars. Mr. COREY

8. METALLURGICAL ANALYSIS. Sem. 2, Cr. 3. Technical methods of analysis of coals, slags, and industrial products. Prerequisite: Chemistry 9. Deposit, ten dollars. Mr. COREY

9. PYROMETRY AND ALLOYS. Sem. 2, Cr. 2. One lecture and one laboratory period. Methods of measuring high temperatures. Union of metals by fusion, compression and electro-deposition; the behavior of metals and alloys under heat. Laboratory practice in thermal measurements, synthesis and testing of alloys. Deposit, three dollars. Mr. COREY

10. METALLOGRAPHY. Sem. 1, Cr. 2. One lecture and laboratory period. The constitution and microstructure of metals and alloys, especially iron and steel. The preparation and study of metal sections, photomicrography and the use of the microscope to aid in testing structural iron and steel. Deposit, three dollars. Professor DANIELS

11. METALLURGICAL PROBLEMS. Sem. 1, Cr. 1. Physical chemistry for the metallurgist, slag calculations, etc., illustrated by figures quoted from the present practice at a number of smelting plants. Prerequisites: Chemistry 9, and metallurgy 2. Mr. COREY

12. CLAY TESTING. Sem. 2, Cr. 3. One lecture and two laboratory periods. Methods of testing clays, refractory materials, cement-making materials. Deposit, three dollars. Mr. COREY

13. DESIGN OF PLANT. Sem. 1, Cr. 3. Three drafting periods. The designing of a piece of equipment or a structure for mining, milling or metallurgical purposes. Senior or graduate. Professors ROBERTS and DANIELS

THESIS. See mining 6 and 8.

SUMMER FIELD WORK. See mining 7 and 8.

CHEMISTRY

1, 2. GENERAL CHEMISTRY. Cr. 4. Textbooks, Smith's College Chemistry and Laboratory Manual.

Professor BYERS, Instructors and Assistants

1a, 2a. GENERAL CHEMISTRY. Cr. 4. Consists of two lectures and six laboratory hours per week. Textbooks, Smith's General

Chemistry, Smith's Laboratory Manual, and Byers and Knight's Qualitative Analysis. Prerequisite: One year high school chemistry. Professor BYERS, Assistant Professor ROSE and Assistants

1b. GENERAL CHEMISTRY. Sem. 2, Cr. 4. Repetition of 1a. Strong students or those carrying light course will be permitted to elect this course without the prerequisite high school course; but to satisfy the required work of the engineering curricula, such students must elect some other four-hour course in the department of chemistry. Assistant Professor ROSE

2b. GENERAL CHEMISTRY. Sem. 1, Cr. 4. Continuation of 1b. Assistant Professor ROSE

1d. PROSPECTOR'S COURSE. Cr. 4. For miners who may enter January 1, and will continue to April 1. Does not require previous knowledge of chemistry, and will be merged into a course of qualitative analysis. The text is Brownlee. Deposit, ten dollars per semester. Associate Professor BENSON

9. QUANTITATIVE ANALYSIS. Sem. 1-2, Cr. 4. Gravimetric and volumetric analysis. Olsen's Quantitative Analysis. Twelve laboratory hours and one recitation per week.

Associate Professor BENSON

ENGLISH

1a, 1b. ENGLISH COMPOSITION. Sem. 1-2, Cr. 2. A brief consideration of the principles of rhetoric with practice in theme writing. Messrs. BENHAM, DARBY, JOHANSON and SAWYER

GEOLOGY

1a. GENERAL GEOLOGY. Sem. 1, Cr. 4. For engineering and mining students. Professor LANDES

9. MINERALOGY. Sem. 2, Cr. 4. Two laboratory periods. Descriptive and determinative mineralogy. Laboratory fee of \$2.00. Dr. WEAVER

13. OPTICAL CRYSTALLOGRAPHY. Sem. 1, Cr. 4. Two recitations and two laboratory periods per week. Laboratory fee of \$2.00. Dr. WEAVER

16. PETROGRAPHY. Sem. 2, Cr. 4. A study of the distinguishing characteristics of the different groups and species of rocks with practice in their determination by modern petrographical methods. Prerequisite: 1a, or 1, or 4, 5, 6. Dr. WEAVER

17. ECONOMIC GEOLOGY. Sem. 2, Cr. 4. Four recitations per week. Professor LANDES

18. PALEONTOLOGY. Cr. 4. Three recitations and one laboratory period per week. Chiefly for students in geology and mining. Dr. WEAVER

19, 20. FIELD WORK. Credits and time to be arranged for arts students. One hour or eight days in second semester for mining engineers.

Professors LANDES, SAUNDERS, and Dr. WEAVER

B. PROSPECTORS' GEOLOGY AND MINERALOGY. Lectures, recitations, and laboratory work in general geology and mineralogy. This course is given in January, February, and March, to the students in the short course for mining men. Dr. WEAVER

MATHEMATICS

1a. PLANE TRIGONOMETRY AND ALGEBRA. Sem. 1-2, Cr. 4. Primarily for students in the Colleges of Engineering, Forestry and Mines. Supplementary work in algebra equivalent to one hour per week throughout the semester.

2a. ANALYTICAL GEOMETRY AND ALGEBRA. Sem. 1-2, Cr. 4. Primarily for students in the Colleges of Engineering, Forestry and Mines. Supplementary work in algebra equivalent to one hour per week throughout the semester. Nichol's Analytic Geometry, Hawkes' College Algebra.

3a, 4a. CALCULUS FOR ENGINEERS. Sem. 1-2, Cr. 4. May be begun either semester. A first course in calculus with special reference to the needs of engineering students.

5a. APPLICATIONS OF DIFFERENTIAL AND INTEGRAL CALCULUS. For students in the College of Engineering, Forestry and Mines.

PHYSICS

1a. MECHANICS AND WAVE MOTION. Sem. 1 or 2, Cr. 4. This course must be accompanied by 1b.

Professor OSBORN and Dr. GRONDAHL

2a. LIGHT, HEAT, ELECTRICITY. Sem. 1 or 2, Cr. 4. This course must be accompanied by 2b. Dr. GRONDAHL

1b. PHYSICS MEASUREMENT. Sem. 1 or 2, Cr. 2. One four-hour laboratory period. Six dollars deposit per year.

Mr. LESTER and Assistants

2b. PHYSICS MEASUREMENTS. Sem. 1 or 2, Cr. 1. One three-hour laboratory period.

Mr. LESTER and Assistants

POLITICAL AND SOCIAL SCIENCE

1. ELEMENTS OF ECONOMICS. Sem. 1-2, Cr. 4. Dr. McMAHON

CIVIL ENGINEERING

1. ENGINEERING DRAWING. Sem. 1-2, Cr. 2. Linear drawing; Roman and Gothic capital letters. Prerequisite: Plane geometry. Assistant Professor HARRIS and ———

3. ENGINEERING DRAWING. Sem. 1-2, Cr. 4. The elements of descriptive geometry, including the principles of shades, shadows and perspective. Prerequisite: Solid geometry, preceded or accompanied by drawing 1.

Assistant Professor HARRIS, Professor McCaustland, Mr. GLEASON, Mr. MUEHLSTEIN, Mr. WERNECKE and Mr. STRANDBERG

4. ENGINEERING DRAWING. Sem. 2, Cr. 2. Continuation of drawing 3. Problems and tracings.

20. PLANE SURVEYING. Sem. 1-2, Cr. 4. Class, field and office work. Prerequisites: Drawing 1 and mathematics 1a.

Mr. GLEASON, Mr. MUEHLSTEIN and Mr. NEWTON

23. TOPOGRAPHIC SURVEYING. Sem. 1, Cr. 3. Base line measurement. Reading, adjusting and computing triangulation systems. Methods of making topographic and hydrographic surveys, including phototopography and cartography. Prerequisites: Surveying 21, mathematics 4b.

Mr. MILLER

28. MINE SURVEYING. Sem. 1-2, Cr. 3. Use of instruments designed for mining work. Methods of carrying a meridian underground and underground practice. Surface surveying of mineral claims for patent. Prerequisite, 20.

Mr. NEWTON

41, 42. MECHANICS. Sem. 1-2, Cr. 5: 41. Sem. 1-2, Cr. 4: 42. Statics, dynamics and mechanics of materials. Prerequisites: Mathematics 4b, physics 1a.

Associate Professor MORE, Acting Assistant Professor SCHROEDER, Mr. ADLER, Mr. MUEHLSTEIN and Mr. WERNECKE

50. HYDRAULICS. Sem. 2, Cr. 4. Flow of water through pipes and orifices, over weirs and in open channels; energy, impulse and reaction of jets with application to impulse wheels. Review of hydrostatics. Preceded or accompanied by 42.

Assistant Professor HARRIS and Mr. STRANDBERG

ELECTRICAL ENGINEERING

6. ELECTRICAL ENGINEERING. Sem. 2, Cr. 3. The application of electricity to mining. For students in mining engineering.

Mr. MALLORY and Mr. WAGNER

MECHANICAL ENGINEERING

1. CARPENTRY AND WOODTURNING. Sem. 1-2, Cr. 2.

Mr. BEATTIE and Mr. THERKELSEN

3. FORGE AND FOUNDRY. Sem. 1-2, Cr. 2. Mr. KANE

4. MACHINE WORK. Sem. 1-2, Cr. 2. Mr. KANE

9. MINE TIMBER FRAMING. Sem. 2, Cr. 2. Mr. BEATTIE

10a. MACHINE DESIGN. Sem. 1-2, Cr. 1. First five weeks. For students taking mining engineering, an abridgment of 10.

Mr. THERKELSEN

GENERAL INFORMATION

HISTORICAL

The foundation for the establishment of the University of Washington was laid in 1854 when Governor Isaac Ingalls Stevens, in his message to the first legislature, recommended that Congress be memorialized to appropriate land for a university. Two townships were subsequently granted, and in January, 1861, the legislature finally located the Territorial University at Seattle.

On February 22nd (Washington's Birthday) the Reverend Daniel Bagley, John Webster, and Edmund Carr, composing the board of University Commissioners, met and organized for work. Ten acres of land were donated by Hon. Arthur A. Denny, Charles C. Terry and Edward Lander from their adjoining farms, and on May 21, 1861, the cornerstone of the main building was laid and the building completed in specified time.

On November 4th following, the University was opened for students.

ENVIRONS

The University is surrounded by many things of educational value to the students. Seattle affords the advantages of a metropolis. Its excellent library, its parks, public schools, and churches have a wholesome influence upon university life.

The state legislature in 1895 enacted a law prohibiting the sale of intoxicating liquors within a radius of two miles of the University grounds. This insures a college neighborhood entirely free from the evils of the saloon.

GOVERNMENT

Under the constitution and laws of the State of Washington, the government of the University is vested in a Board of Regents, consisting of seven members appointed by the governor by and with the advice and consent of the senate. Each regent is appointed for a term of six years.

ENDOWMENTS AND SUPPORT

The University derives its support entirely from the state. As yet the property belonging to the institution as an endowment yields little revenue. The income from this property will some day greatly help to support the University. The property of the University includes:

(1) The two townships of land granted by Congress in 1854. There remains of this old grant some three thousand acres.

(2) The old University site, consisting of the tract of 8.32 acres, donated in 1861 by Arthur Denny and wife; and 1.67 acres, donated by C. C. Terry and wife and Edward Lander. This

"ten-acre tract" is situated in the very heart of Seattle, and is rapidly enhancing in value.

(3) In addition to the above the University was further endowed by the state on March 14, 1893, by the segregation of 100,000 acres of lands.

BEQUESTS

In the legislative session of 1897 in the Code of Public Instruction is the following provision for University bequests:

"The Board of Regents is authorized to receive such bequests or gratuities as may be granted to said University, and to invest or expend the same according to the terms of said bequests or gratuities. The said board shall adopt proper rules to govern and protect the receipt and expenditure of the proceeds of all fees, bequests, or gratuities, and shall make full report of the same in the customary biennial report to the governor, or more frequently if required by law."

STUDENT EXPENSES

TUITION

The tuition is free to all students of the State of Washington in all colleges and schools of the University, except in the School of Law and in the Summer Session. In the School of Law the tuition is \$20.00 a semester, or \$40.00 for the year. In the Summer Session the tuition is \$10.00, as the Summer Session is conducted, to a large extent, independently of state support.

ASSOCIATED STUDENTS FEE

The Associated Students Fee of five dollars is paid by every student on entering the University. See page 36.

LABORATORY DEPOSITS

A laboratory deposit is charged in all laboratories, calculated in amount to cover the cost of the materials used and the expenses of the work incurred by the individual students. Hence the amount of the deposit varies in the different laboratories, varying from \$1.00 to \$15.00 a semester as shown in the announcement for the several departments.

BOARD AND ROOM

(a) In the University Dormitory the room rent (\$12.00 a semester) is payable in advance and no rooms will be reserved unless paid for. Board bills are payable monthly as the bills are rendered. The rooms are furnished with necessary articles of plain furniture, but the student is expected to supply his own bed linen, bedding, mattress, towels, floor rug, and any articles of luxury that may be desired.

A deposit of fifteen dollars, which is returned at the end of the year, must be made with the bursar in advance by all students desiring to live in the dormitory.

(b) Outside the dormitory, in the past, the expense of board

and lodging with private families has ranged from twenty-three to thirty dollars per month.

Since, in the judgment of the University, it is deemed advisable that men and women room in different houses and that women room only in houses which furnish a first-floor reception room for the entertainment of men callers, all first-year women are required to communicate with the Dean of Women before securing rooms.

CADET UNIFORM

The uniform with which the members of the cadet corps are required to provide themselves costs about fourteen dollars. The amount necessary to cover this cost is deposited with the Bursar of the University. The uniform is designed to be worn in place of civilian dress.

DIPLOMA FEE

The fee charged to graduates is five dollars for each one receiving a baccalaureate or higher degree, or a diploma in pharmacy, and three dollars for each one receiving a teacher's diploma.

STUDENT HELP

Many students who have found it necessary to support themselves while at the University have been enabled to do so by securing occupation of various sorts. Students needing work to help pay their way through the University are given every possible aid by the Faculty Committee on Student Assistance. There is also an employment bureau conducted by students to secure work for men who have to make their own expenses. The Dean of Women renders a similar service for women. The official records of the recorder's office shows that twenty-three (23%) per cent. of the students enrolled in 1910-11 are entirely self-supporting, while thirty-two (32%) per cent. more are partially dependent upon their own resources.

DEAN OF WOMEN

The Dean of Women is always ready to help or advise any woman student who may need such assistance. She will supply lists of approved boarding and lodging places, correspond with parents or guardians who desire to make inquiry concerning their daughters or wards, and take an interest in all the women's organizations.

SCHOLARSHIPS

THE JOHN WALTER ACKERSON SCHOLARSHIP

In memory of the late John Walter Ackerson, a pioneer of Washington, Mrs. S. Louise Ackerson offers a scholarship of one hundred dollars annually to the young woman member of the junior class who may be adjudged most worthy on the basis of scholarship, personal influence and self reliance.

ANONYMOUS

A friend of the University has provided a scholarship of one hundred and fifty dollars to be awarded annually to a student of

the department of chemistry on the basis of scholarship in the courses taken in the department, of scholarship in other departments, and of personality.

SENIOR SCHOLARS

In June preceding their senior year, juniors who have eighty-eight or more credits with high grade may be elected senior scholars. A senior scholar may be relieved from attendance at regular lectures or recitations, and may be granted other special privileges in order that he may devote himself to more intensive and more correlated study than the class-room system permits. His work must be in not less than two nor more than four allied subjects; and it must be correlated so that it will bear upon some common field.

PRIZES

THE JUDGE ALFRED BATTLE PRIZE

Judge Alfred Battle offers an annual cash prize of seventy-five dollars to the Washington debating team chosen to meet representative debaters from the University of Oregon.

THE PHILO SHERMAN BENNETT PRIZE

The Philo Sherman Bennett prize of twenty-four dollars annually is "for the best essay discussing the principles of free government."

THE E. F. BLAINE PRIZE

In 1907 Mr. E. F. Blaine, of Seattle, assumed the annual cash prize of \$100.00 formerly offered by the King County Bar Association as an incentive for oratory. This prize is competed for annually by the students of the Universities of Washington, Oregon and Montana, and is known as the E. F. Blaine prize for oratory.

THE L. J. CORKERY PRIZE

Mr. L. J. Corkery, of Toledo, Ohio, supplements the Blaine prize for oratory by offering a fifteen-dollar cash prize for second honors in the contest between the Universities of Washington, Oregon and Montana.

THE ALDEN J. BLETHEN PRIZES

Hon. Alden J. Blethen offers annually the sum of one hundred dollars for prizes in declamation. The contests are held at the University each year. They are open to pupils in attendance at any accredited high school of the state. The prizes are twenty-five dollars for first place, fifteen dollars for second place, and ten dollars for third place in each contest.

THE JUDGE THOMAS BURKE PRIZES

Judge Thomas Burke, of Seattle, offers a scholarship of sixty dollars annually to the student in the department of Latin who does the best work in the sophomore year.

Judge Burke has also provided two annual prizes of \$30.00 each, for the departments of French and German, to be awarded

to the major student in French or German, who at the end of the junior year has done the most satisfactory work.

THE VIVIAN W. CARKEEK PRIZE

Mr. Vivian W. Carkeek of the Law class of 1901 offers an annual cash prize of \$25.00 for the best thesis on Washington law.

THE LORETTA DENNY FELLOWSHIPS

By the will of Sarah Loretta Denny the sum of \$25,000 was bequeathed to this University for the establishment of University fellowships. The income from this fund is at present \$1,250.00, and affords three graduate fellowships of equal amount, which will be awarded by May 1st of each year by the graduate faculty.

THE FUNK AND WAGNALLS PRIZE

The Funk & Wagnalls Company give annually a prize consisting of a copy of their Standard Dictionary for the best work in Freshman English.

THE JACOB FURTH PRIZE

Mr. Jacob Furth offers an annual scholarship of one hundred dollars, to be awarded at commencement, to the senior student in electrical engineering who shall have done the best work in physics, mathematics, and electrical engineering during his course.

SEATTLE BAR ASSOCIATION

Each alternate year, beginning with the spring of 1908, the Seattle Bar Association will give the sum of fifty dollars to defray the expenses of a debate between representatives of the Law Schools of Oregon and Washington.

KERL PRIZE

The Kerl cash prize of \$100.00, provided by Thomas T. Kerl, of Coeur d'Alene, Idaho, is awarded for the best paper on an industrial topic involving the products of the Pacific Northwest.

E. P. STRANDBERG SCHOLARSHIP

The Society for Preservation of Swedish Language and Culture in America offers annually a scholarship of \$25.00, known as the E. P. Strandberg Scholarship, to be awarded to the student earning the highest credits in the Swedish language and literature.

THE NORWEGIAN NATIONAL LEAGUE SCHOLARSHIP

The Norwegian National League offers a scholarship of \$25.00 to be awarded to the student earning the highest credits in Norwegian language and literature.

THE DANISH-AMERICAN SCHOLARSHIP

The Danish Vice-Consul offers a scholarship of \$25.00, known as The Danish-American Scholarship, to any student of the Scandinavian department who writes the best article in the English language on Danish and Icelandic history.

THE WASHINGTON BANKERS ASSOCIATION PRIZE

The Washington Banker's Association awards a prize of twenty-five dollars for the best essay on an economic topic to be selected by the executive committee of the association.

THE REMSBERG GIFT

Mr. and Mrs. Charles E. Remsberg have given \$1,250.00 to the University library for the purchase of Pacific Northwest history materials; \$250 for the year 1910 and \$100 for each of ten years beginning January 1, 1911.

BAILEY AND BABETTE GATZERT FOUNDATION

A thirty thousand dollar foundation, known as The Bailey and Babette Gatzert Foundation of Child Welfare of the University of Washington, has been established by Sigmund Schwabacher and the executors of the will of the late Abraham Schwabacher. The object of the foundation is to furnish relief for defective children. The foundation represents philanthropic work of the most advanced type.

ASSOCIATIONS AND CLUBS

ALUMNI ASSOCIATION

The officers of the Alumni Association for 1911-1912 are as follows: President, Dr. Don H. Palmer; secretary, Mr. Loren D. Grinstead; treasurer, Mr. James E. Gould.

THE ASSOCIATED STUDENTS

The Associated Students of the University of Washington (incorporated) is an organization of the entire student body. The powers of government are vested by its constitution in an annually elected board of control, upon which three members of the faculty and three alumni also have seats. The board appoints a general manager, who has the financial control of all branches of athletics, musical organizations, and of contests in debate and oratory. The associated student fee of \$5.00 a year entitles the student to a subscription to the University of Washington Daily—the official student paper—free admission to all athletic, debating and oratorical contests given under the auspices of the A. S. U. W., the annual musical concert, the discounts in the co-operative book store, and to all the voting and other privileges of the association.

CHRISTIAN ASSOCIATIONS

The Young Men's and the Young Women's Christian Associations each have a branch organization among the students. They are active in making the new students feel at home and in assisting them in many ways.

A bureau of information and an employment bureau are maintained jointly by the two associations.

CHEMICAL CLUB

The Chemical Club consists of the advanced students and instructors in the department of chemistry as organized at the beginning of each year.

CLASSICAL CLUB

This club is composed of students and members of the faculty who are interested in the life and literature of the Greeks and Romans.

DEBATING CLUBS

There are four debating clubs in the University, viz.: Stevens, Badger, Athena, and Sacajawea. The first two are for men, the last two for women. Membership in the clubs is limited in order that frequent practice may be afforded.

LINCOLN LITERARY SOCIETY

The Lincoln Literary society offers to students in all departments of the University an opportunity for developing proficiency in public speaking and a knowledge of the various forms of English composition.

DEUTSCHER VEREIN

The Deutscher Verein is an organization of students and instructors interested in the study of the German language and literature, and of German life and culture.

THE FOREST CLUB

The Forest Club has for its object the bringing of the students in the School of Forestry into closer relationship, and to render mutual assistance along professional lines.

FRENCH CLUB

Membership in the French Club is open to both students and instructors. Students who have studied French at least two years are invited to attend the meetings.

MATHEMATICAL CLUB

The Junior Mathematical Club is open to every student of the University who is sufficiently interested in mathematics to contribute something toward a program at least once during the year.

The Mathematics Journal and Research Club consists of teachers and advanced students in the department of mathematics.

MUSICAL ORGANIZATIONS

The musical organizations consist of the University Choral Society, Men's Glee Club, Women's Glee Club, Orchestra and Band.

The Mozart Club exists for the purpose of furthering the musical interests of the University, of promoting a closer relationship among the members of the musical organizations.

PHILOLOGICAL ASSOCIATION

The Philological Association was organized to encourage scientific investigation in language and literature. Membership is

open to all members of the University who are interested in philology.

POLITICAL SCIENCE CLUB

This club is composed of students and members of the faculty interested in political science.

SIGMA XI

A chapter of the national society of Sigma XI has been established at the University. The purpose of the society is to encourage research work along scientific lines. Its membership is composed of teachers and graduate students.

WASHINGTON UNIVERSITY STATE HISTORICAL SOCIETY

The Washington University State Historical Society has for its purpose the preserving of the historical documents and records of the Northwest, and of the State of Washington, and to preserve or publish the results of all such investigations.

EQUIPMENT

GROUNDS

The grounds are ample to meet every need of the University. There are three hundred and fifty-five acres, all within the city limits of Seattle, lying between Lakes Union and Washington, with a shore line of over one mile on Lake Washington and about a quarter of a mile on Lake Union.

BUILDINGS

The following is a list of the buildings now in use on the University campus: Administration Building, Auditorium, Astronomical Observatory, Bagley Hall, Denny Hall, Two Dormitories (Lewis Hall for men and Clarke Hall for women), Education Building, Engineering Building, Forestry Building, Forge and Foundry Building, Good Roads Building, Gymnasium, Hydraulic Laboratory, Law Building, Library Building, Mining Building, Museum, Music Building, Power Plant, Science Hall, Mines Rescue Training Station, Armory for the Cadet Battalion, Executive residence, Faculty Club House, Student Men's Club, Women League Building, Engineer's residence, and Electrician's residence.

LIBRARY

There are now 47,793 bound volumes in the library. The library is a designated depository and possesses almost a complete set of United States government publications. The library receives regularly 394 periodicals, including standard magazines and leading technical journals, both American and foreign.

MUSEUM

The several collections composing the University Museum, which is also a state museum, contain numerous materials of general museum interest and much material illustrative of the instruction in anthropology, biology, geology and forestry.

Valuable collections have been given or loaned to the museum; among these are the group of mountain sheep, the gift of Hon. Wm. E. Humphrey; the collection of over 100 mounted fishes, the gift or loans of Mr. Edwin C. Starks; bird collections received from Prof. O. B. Johnson, Mr. L. M. Turner, Mr. H. H. Hindshaw, Dr. Clinton T. Cook and Mr. George G. Cantwell; the large collection of molluscs, the gift of Mr. P. B. Randolph; the collection of shells and crustacea, the property of Prof. O. B. Johnson; and the rare collection of insects secured by Prof. Trevor Kincaid while in Japan and Russia. Many valuable government collections, most of which are subject to withdrawal, are on exhibition, as is also the famous collection made in Alaska by Lieutenant George T. Emmons, a valuable collection on which the University has been allowed an option.

LABORATORIES

The University of Washington has the following laboratories equipped for work in the various departments:

BOTANY LABORATORIES

The botanical and bacteriological laboratories are on the third floor of Science Hall. They occupy about 5,000 feet of floor space divided as follows: Three large laboratories of about 1,200 square feet each; three small laboratories, one for small classes and advanced work, one for taxonomic and field work, one for a media-room for bacteriology; one dark room; one private laboratory. On the fourth floor is the herbarium.

The laboratories are fitted with the apparatus and conveniences usual for the work.

CHEMISTRY LABORATORIES

The chemistry laboratories are housed in a thoroughly modern fireproof building designed after the most approved models, combining the good features of the best chemistry buildings in the country. There are fully equipped separate laboratories devoted to general chemistry, analytical chemistry, food inspection and analysis, organic chemistry, physiological chemistry, industrial chemistry, and pharmaceutical chemistry. All laboratories are equipped with hoods with forced drafts, water, gas, distilled water, air under pressure, and where most needed, with hydrogen sulphide and steam. The industrial or chemical engineering laboratories are equipped with the fundamental types of apparatus

used in manufacturing processes, such as filter press, hydraulic press, stills, grinding apparatus, heating furnaces, and vacuo drying oven.

CIVIL ENGINEERING LABORATORIES

HYDRAULIC. The high pressure equipment consists of small impulse wheels, nozzles and orifices connected to a header under a pressure of two hundred and sixty-five feet. For low head experiments and pump tests there is a set of tanks and measuring weirs. Larger weirs are placed in streams near the campus, making it possible for regular work to be conducted under ordinary field conditions. Current meters and other auxiliary apparatus are available for both field and laboratory work.

STRUCTURAL MATERIALS. The structural materials testing laboratory contains five universal testing machines with capacities from thirty thousand to two hundred thousand pounds, two impact machines with various hammers ranging in weight from fifty to fifteen hundred pounds, with the necessary auxiliary apparatus for general work.

CEMENT. The equipment for testing hydraulic cement is complete for all the ordinary tests as specified by the American Society of Civil Engineers.

ROAD. The road laboratory is equipped for testing materials used in the construction of roads. The machines for the abrasion and toughness tests are of the standard designs adopted by the American Society for Testing Materials; other machines are similar to those used by the U. S. Office of Public Roads.

SURVEYING. The equipment consists of an ample supply of all the necessary instruments for plane and topographic surveying.

ELECTRICAL ENGINEERING LABORATORIES

The dynamo laboratory contains fifteen alternating and thirty direct current generators and motors. The machines are of modern design and have a combined capacity of two hundred and ninety kilowatts in direct current machines and two hundred and ten kilowatts in alternating current machines. Most of the machines are of five and ten-kilowatt capacity. Power from a storage battery of one hundred and thirty cells is available at a separate switchboard in the dynamo laboratory. The University power-house, containing two steam driven units of two hundred and one hundred kilowatts, serves as a commercial laboratory for operating and testing purposes.

Nine smaller rooms are devoted to the following: (a) Instrument making and repairing, (b) grinding room and shop, (c) instrument and stock room, (d) telephone laboratory, (e) electrolysis and special thesis problems, (f) storage battery room, (g) three dark rooms for photometry work. The instrument room contains a large collection of standard indicating and recording meters. The photometry rooms are equipped with Matthews integrating and bench photometers.

FORESTRY LABORATORIES

DENDROLOGY. Individual lockers, compound microscopes, gas and water. An herbarium of fruits, twigs and trunk sections of trees is well under way. **LUMBERING.** Field work at logging camps and sawmills. A complete equipment for exercises in logging engineering; for demonstration, collections of lumber, showing grades, defects, planing mill products, saws, axes, cables and other apparatus used in logging and milling. There are mills and camps about Seattle. **MENSURATION.** Equipment selected to show all principal types of instruments in use. Those particularly adapted to the northwest provided in quantities sufficient for all practice work by students in cruising, and volume, growth and yield studies. **SILVICULTURE.** Greenhouse space and a forest tree nursery are provided on the campus. The forests about Seattle offer wide opportunities for other practical studies and demonstrations. **TIMBER PHYSICS.** The magnificently equipped Government Timber Testing Laboratory, operated in co-operation with the University, is used. **WOOD TECHNOLOGY.** Same room as Dendrology Laboratory. Individual lockers, gas, water, Leitz compound microscopes, and a complete equipment for micro-technique and for studies of the various technical qualities of woods. Extensive collections of domestic and foreign commercial timbers and microscopic preparations. **WOOD PRESERVATION AND UTILIZATION.** A modern open tank preservation plant. Three large commercial treating plants and many plants utilizing secondary forest products are available for study in Seattle. **LECTURE ROOMS.** Supplied with Leitz lantern for episcopic, diascopic, and microscopic projection.

GEOLOGY LABORATORIES

The geology laboratories, four in number, are in Science hall, two on the first floor, and two occupying the well-lighted basement rooms at the southwest end of the building, consisting of a laboratory for general geology, physiography and climatology, supplied with a seismograph for assistance in the study of earthquake phenomena. It is the Bosch-Omori type, very sensitive, recording distant earthquakes of small intensity. The department is equipped with the usual weather bureau instruments, barograph, mercurial and aneroid barometers, thermograph, maximum and minimum thermometers, anemometer and tipping-bucket rain gauge with self-recording apparatus, situated in the laboratory; also numerous charts and maps necessary for the work.

The mineralogy laboratory has been especially designed, and is supplied with eight tables made with tile tops and provided with gas fixtures. A laboratory for map modeling and erosion work is provided in connection with the courses in physiography and general geology. A room is fitted with lathes, diamond saw, and grinding plates run by electric motor for preparation of rock slides for petrographic study.

MECHANICAL ENGINEERING LABORATORIES

The steam and experimental laboratory is fully equipped with steam apparatus, including engines aggregating 900 H. P., of simple and compound, high speed and Corliss types; steam turbine; jet and surface condensers; injector; centrifugal pump; steam calorimeters; indicators; calibrating appliances; gas engine; compressed air machinery for two stage compression and Westinghouse full train equipment; fuel testing facilities, including Mahler Bomb, Junkers and other calorimeters, with accessories for determining heating value and analyses of solid liquid and gaseous fuels.

There is a thoroughly modern woodworking shop, machine shop, foundry and forge shop. The woodshop is equipped with benches, lathes, band saws, circular saws, planer, and trimmer. The Forge and Foundry are equipped with down-draft forges, power hammer, punch and shears, cupola, moulding machines, shakers, rattler, riddles, brass furnace, core oven, and traveling crane. Machine shop is equipped with small and large lathes, drill press, milling machine, planer, shaper, metal saw, grinding machine and complete equipment for bench and vise work.

MINES AND METALLURGY LABORATORIES

The Mines building contains the stamp milling, concentrating and coal washing plant, the mining laboratory, and the metallurgy laboratory. The United States Mine Rescue Training Station occupies a separate building nearby. The "smokeroom," fitted with track and car, overcast airway, doghole, and smudge floors, is the largest of its kind in the country. Several sets of the Draeger oxygen apparatus and pulmoter are kept on hand for practice as well as for use in mine rescue work.

PHARMACY AND MATERIA MEDICA LABORATORIES

The rooms devoted to pharmacy and materia medica are located in Bagley Hall. A room accommodating thirty-two students working at one time is used for manufacturing pharmacy. Work in prescription practice receives special attention in a room constructed as a model prescription pharmacy. The materia medica room contains a drug museum of several hundred samples of official and unofficial crude drugs. This room is fitted with desks suitable for microscopic work. Work in drug assaying and the several courses in chemistry are located in suitable rooms in other parts of the building.

PHYSICS

The laboratories set apart for the use of the department consist of: (1) A general laboratory for students in arts and sciences, (2) a general laboratory for students in applied science, (3) an electrical laboratory, (4) a heat laboratory, (5) a sound and light laboratory, (6) a photometry room, (7) a battery room.

The laboratories are supplied with apparatus from the best American and European makers.

BUREAU OF TESTING

The bureau is equipping itself as rapidly as possible to meet the demand for a bureau where scientific instruments may be accurately calibrated and tested. The standards of the bureau will be calibrated by our National Bureau of Standards at Washington, D. C.

The bureau is prepared to calibrate direct and alternating current instruments, to determine candle power of lamps, to measure temperature, both high and low, and to a limited extent to standardize weights. Those desiring to have work done should address the director, Frederick A. Osborn.

PSYCHOLOGY LABORATORY

The psychology laboratory occupies four rooms on the fourth floor of Science hall. The equipment of the laboratory includes: Five Koenig forks; an Edelmans Galton whistle sonometer; two organ pipes; bellows and rubber windbag for actuating pipes; Ellis harmonical, and other minor instruments for acoustical work; colored papers, Herings color-blindness tester, Hering's binocular color-mixer, Hering's color-mixer and campimeter; six electro-motors, ophthalmoscope, ophthalmotrope, stereoscopes, pseudoscope, a clock-work kymograph, a Zimmerman ergograph, a Lehman plethysmograph; a Hipp chronoscope and accessories; materials for experimentation on the cutaneous sensations and taste and smell.

ZOOLOGY LABORATORIES

The laboratory work of the department of zoology is conducted in six rooms located on the second floor of Science Hall. Here are adequate facilities for pursuing the following lines of investigation: General zoology, histology, anatomy, physiology, entomology and research.

OBSERVATORY

The observatory is housed in a substantial sandstone structure which provides space for the equatorial instruments, the transit, and for computing purposes. The instruments include a six-inch refracting telescope and accessories; a Bamberg transit, Riefle clock, Bond chronometer, a barometer, sextants, etc. The minor equipment is sufficient for performing the usual experiments in laboratory and lecture work in astronomy.

ADMISSION AND GRADUATION

ADMISSION TO THE FRESHMAN CLASS

The following fixed requirements have been made for the years 1911-12 to 1914-15, inclusive:

Applicants for admission to the freshman class must either (a) pass an examination based on a four-year course amounting in the aggregate to fifteen units, or (b) complete a course of the same length in an accredited school. Of these fifteen units, eight and one-half are prescribed and required of all applicants; from two to four more are prescribed for entrance to each college or group; the rest are elective from the list of optional subjects. Applicants for admission to the first year law class must, in addition to the above, present one year's work in the College of Arts and Sciences, or its equivalent. (Beginning September, 1913, two years of work in Arts and Sciences will be required for admission to Law.)

I. Subjects prescribed for all: Algebra, $1\frac{1}{2}$ units; plane geometry, 1 unit; physics, 1 unit; *English, 4 units; a history, 1 unit (American history preferred); or U. S. history and civics, 1 unit; total, $8\frac{1}{2}$ units.

II. Additional subjects prescribed for the several schools and colleges.

(a) College of Arts and Sciences.

GROUP 1.		GROUP 2.	GROUP 3.
DIVISION 1. CLASSICAL.	DIVISION 2. MODERN LANGUAGE— LITERATURE.	MATHEMATICS AND SCIENCE.	PHILOSOPHICAL.
Foreign language, 4 units, at least 2 units being Latin.	Foreign language, 4 units.	A foreign language, 2 units. Chemistry or Biology, 1 unit. Solid Geom., $\frac{1}{2}$ unit.	Same as for Group 1 or 2.

*A student presenting four units of foreign language may be admitted with three instead of four units of English.

A student presenting one or more units of foreign language in excess of the requirements for the group he desires to enter may be admitted with three instead of four units of English.

NOTE.—For further requirements for admission to the Department of Music, see Bulletin of the College of Arts and Sciences, page 102.

(b) College of Engineering and College of Mines. A foreign language, 2 units; chemistry, 1 unit; solid geometry, $\frac{1}{2}$ unit.

(c) College of Forestry. A foreign language, 2 units; botany, 1 unit; solid geometry, $\frac{1}{2}$ unit.

(d) College of Pharmacy. A foreign language, 2 units.

(e) School of Law. Same requirements as specified for any college and the completion of 34 hours in the College of Arts and Sciences. (After 1912-13, two years in Arts and Sciences will be required.)

NOTE.—A candidate may present for entrance any modern foreign language in which he has had a course fairly equivalent to a high school course in English, *i. e.*, which he has used as a spoken and written language and of which he has studied the grammar and literature.

OPTIONAL SUBJECTS.

Agriculture, 1 or $\frac{1}{2}$ unit.§

Astronomy, $\frac{1}{2}$ unit.

*Bookkeeping, $\frac{1}{2}$ unit.†

Botany, $\frac{1}{2}$ or 1 unit.

Chemistry, 1 unit.

Civics, $\frac{1}{2}$ unit.

*Commercial Arithmetic, $\frac{1}{2}$ unit.†

*Commercial Law, $\frac{1}{2}$ unit.†

Drawing, $\frac{1}{2}$ or 1 unit.

Economics, $\frac{1}{2}$ unit.

*Economic Geography, $\frac{1}{2}$ unit.†

French, 1, 2 or 3 units.

†Geology, $\frac{1}{2}$ or 1 unit.

German, 1, 2, 3 or 4 units.

Greek, 1, 2, 3 or 4 units.

History, 1, 2 or 3 units.

*Home Economics, 1 or 2 units.§

Latin, 2, 3 or 4 units.

†Physical Geography, $\frac{1}{2}$ or 1 unit.

†Physiology, $\frac{1}{2}$ or 1 unit.

*Shop Work, 1 or 2 units.

Solid Geometry, $\frac{1}{2}$ unit.

Spanish, 1 or 2 units.

Trigonometry, $\frac{1}{2}$ unit.

Zoology, $\frac{1}{2}$ or 1 unit.

*The aggregate amount presented in the following subjects, *viz.*: Bookkeeping, Commercial Arithmetic, Commercial Law, Drawing, Economic Geography, Home Economics and Shop Work, may not exceed 3 units.

†1 unit accepted only after approval of a definite laboratory course.

†Before credit can be received, the work in the following subjects, Bookkeeping, Commercial Law, Commercial Arithmetic and Economic Geography, must be specially inspected and the teachers presenting these courses must be up to the standard required for instruction in all other subjects in the high school.

§Credit in Agriculture will be given only on a prerequisite of $\frac{1}{2}$ unit in Botany, and credit for more than one unit in Home Economics will be given only on the prerequisite of one unit in Chemistry.

NOTE 1.—To count as a "unit" a subject must be taught five times a week, in periods of not less than forty-five minutes, for a school year of not less than thirty-six weeks.

NOTE 2.—Group 1, Division 1. While the language requirements for this division are specified in this way as a concession to the smaller high schools, students should by all means present, as the best preparation for entrance to the classical division, four years of Latin, and three years of Greek, wherever it is possible.

NOTE 3.—A graduate of an accredited school may be admitted to the freshman class conditioned in not more than two units. Any student having any entrance condition must so register for work that the condition will be removed by or before the opening of the second year of residence. The Recorder is authorized to hold up the registration of any student not complying with the

above rule. In satisfying entrance requirements by college courses, eight college credits are counted as the equivalent of one entrance unit.

CREDENTIALS

Credentials showing that the applicant has satisfactorily fulfilled the requirements for admission and is recommended by the principal of his school must be presented before the applicant can register. High school diplomas cannot be used for this purpose. Every prospective student is requested to procure from the Recorder a blank certificate of recommendation, have it filled out and signed by his principal, and return it to the Recorder as early in the summer as possible.

Students expecting to enter the University in September, 1912, should see that their credentials are filed in the Recorder's office not later than August 20th.

ENTRANCE EXAMINATIONS

Examinations for entrance are held at the University on Friday and Saturday preceding the opening of each semester. Persons desiring to take these examinations at other times or places should correspond with the Recorder regarding the matter.

REGISTRATION

Both old and new students will be registered on the first and second days of the first semester, Monday and Tuesday, September 16 and 17, 1912.

Re-registration for the second semester will take place during the month of January.

Registration, for entering students only, will occur on the first day of the second semester, Monday, February 3, 1913.

A penalty of \$1.00 is imposed for registration, or change of election, after the regular registration days.

ADMISSION FROM ACCREDITED SCHOOLS

Graduates of accredited high schools are admitted without examination upon the recommendation of the principal and the presentation of a certificate showing that the candidate has creditably completed a course meeting the requirements for admission to the college or school which he wishes to enter.

As a rule, the accredited school list of other state universities will be accepted by the University of Washington. Graduates of accredited schools in other states must present a certified record of work, as in the case of local students.

LIST OF ACCREDITED SCHOOLS

I. PUBLIC HIGH SCHOOLS

Aberdeen, Anacortes, Arlington, Asotin, Auburn, Bellingham (North), Bellingham (South), Blaine, Bremerton-Charlestown, Bothell, Buckley, Burlington Union, Burton Union, Camas, Castle Rock, Centralia, Chehalis, Cheney, Clarkston, Colfax, Colville,

Couppville, Davenport, Dayton, Edmonds, Ellensburg, Elma, Endicott, Enumclaw, Everett, Garfield, Goldendale, Grandview, Granite Falls, Harrington, Hillyard, Hoquiam, Kelso, Kennewick, Kent, Kirkland, La Conner, Latah, Lind, Lynden, Marysville, Monroe, Montesano, Mt. Vernon, Newport, North Yakima, Odessa, Olympia, Outlook, Palouse, Pasco (provisionally accredited), Pomeroy, Port Angeles, Port Townsend, Prosser, Pullman, Puyallup, Richland, Ritzville, Rosalia, Roslyn, Seattle—Broadway, Lincoln, Ballard, Queen Anne; Sedro Woolley, Shelton, Snohomish, South Bend, Spokane, Sprague, Sumas, Sumner, Sunnyside, Tacoma, Toppenish (provisionally accredited), Tekoa, Vancouver, Waitsburg, Walla Walla, Waterville, Wenatchee, Wilbur, Winlock.

II. OTHER SECONDARY SCHOOLS

Adelphia College, Seattle (Academic Department); Brunot Hall, Spokane; Holy Names Academy, Seattle; Seattle Seminary, Seattle; University of Puget Sound (Preparatory Department), Tacoma.

ADMISSION TO ADVANCED UNDERGRADUATE STANDING

Students from classes above the freshman in other colleges of recognized rank, who present letters of honorable dismissal, may be admitted to the advanced standing for which their training seems to fit them. No advanced credit will be given for work done in institutions whose standing is unknown, except upon examination. Definite advanced standing will not be given until the student has been in residence for a semester.

ADMISSION OF NORMAL SCHOOL GRADUATES TO ADVANCED STANDING IN COLLEGE OF ARTS AND SCIENCES

Graduates of approved normal schools receive 48 scholastic credits plus 8 in physical training. For graduation they must present the following specific requirements: Ancient foreign language or literature, 8 hours; modern foreign language, 8 hours; physical science, 8 hours; biological science, 8 hours; economics, 8 hours; philosophy, 8 hours; major subject, 24 hours. On all these points, however (except major), they may have the benefit of the stated exemptions for entrance subjects, and they may also be excused from any prescribed subject for which they have completed a fair equivalent in the normal school, such excuse to be granted by the Dean of the College upon the recommendation of the major professor.

ADMISSION AS SPECIAL STUDENTS

All courses offered by the University are organized for regular students, that is, students who have had the equivalent of a good high school education and have fully met the entrance requirements. *Special students* are admitted to such courses as they may be found capable of undertaking. The following are the

regulations governing the admission and handling of special students in the various schools of the University:

1. In all colleges and schools of the University, except the College of Pharmacy, special students must be at least twenty-one years of age. Special students in the College of Pharmacy must be at least twenty years of age.

2. Special students must present (in credits or by examination) full preparation for the particular courses they wish to pursue.

3. Applicants for special standing shall submit in writing a detailed statement of previous educational work and practical experience, together with an outline of the proposed work in the University and the reasons for wishing the special course. This shall be accompanied by an outline of any educational or other work which the candidate proposes to carry on outside of the University. Said outside work shall not consume more than one-fourth of the student's scholastic hours.

4. Students will not be admitted from an accredited school as special students unless they have graduated, or have not been in attendance for the previous year.

STUDIES

At the beginning of each semester, the student arranges his schedule of studies with the advice and assistance of his class officer. A regular course consists of sixteen hours of recitations per week.

All women students are required to take three hours of gymnasium work per week throughout the first and second years, eight credits in physical culture being required of women for a degree.

A course of two years in military training is required by law. All able-bodied male students (except those from foreign countries, not intending to become naturalized) must take the course which by regulation of the University is required during the first and second year.

Neither the requirement of physical culture for women, nor that of military science for men applies to any student entering as a junior or senior. The deans, together with the physical director, or commandant, as the case may be, have authority to allow a student to substitute the proper corresponding amount of scholastic work for gymnasium or military science when it seems advisable. Substitutions to be valid must be signed by the dean concerned and the physical director or commandant, and must be filed in the office of the Recorder.

REGULATIONS FOR WITHDRAWAL

1. Before October 15 or March 1 of the respective semester, a student may withdraw from a given class with the written consent of his class adviser.

2. Before November 15 or April 1 of the respective semester,

a student may withdraw from a given class with the written consent of his class adviser and instructor.

3. After November 15 or April 1 of the respective semester, a student may withdraw from a given class with the written consent of his class adviser and instructor; provided, however, that if his work has not been satisfactory to the instructor, the instructor must give the student an "E" on the semester grade. It is further provided, that if any withdrawal will reduce the student's hours below twelve, such withdrawal cannot be made till the Dean gives his written approval.

4. Any student who registers for a given course must ultimately complete that course, or if that be impossible, must complete the same number of hours in some other approved subject, in addition to the total number of hours otherwise required for graduation. (Students who may be properly withdrawn with the consent of the class adviser alone shall not be affected by this rule, but it shall not exempt any student from the necessity of completing his required courses.)

SCHOLARSHIP STANDING

(a) Any student who, in any semester, is reported as doing unsatisfactory work in more than one-half of his registered hours will be dropped from the University for the remainder of that semester and for the following semester.

(b) Any student who, in any semester, is reported as doing unsatisfactory work in more than one-quarter of his registered hours will be placed on probation for the remainder of that semester and for the following semester. During the full probationary period the student must pass in twelve hours; or in all his hours, if he is registered for less than twelve.

Monthly reports are made to the Recorder, by all instructors, of students whose work for the preceding four weeks has been unsatisfactory.

EXAMINATIONS

The regular semester examinations are held twice each year. Examinations for the first semester are held the last week of the first semester, while those for the second semester are held during the week prior to Commencement week.

In the College of Arts and Sciences, the examinations held at the end of the first semester are merely qualifying (except for students of other colleges or schools of the University, who are taking courses in the College of Arts and Sciences); *i. e.*, students failing to pass them are not allowed to take the year examinations, which are given in June and cover the work of both semesters.

The following provision will go into effect in 1912-13: "In addition to the regular year examinations in other subjects, senior students in the College of Arts and Sciences shall take examinations in all the work of their major subject and in all the subjects in their group which they have taken in their junior and senior years.

DEGREES

The courses leading to baccalaureate degrees in the College of Arts and Sciences, the College of Engineering, the College of Mines, and the College of Forestry, are arranged to cover a period of four years. The course in the College of Pharmacy covers two years, and an advanced course takes two years longer. To complete the course in the School of Law three years are required. The courses leading to the masters' degree are not less than one year.

In the College of Arts and Sciences are given the degrees of bachelor of arts (A.B.) and bachelor of science (B.S.); in the College of Engineering, bachelor of science (B.S.); in the College of Mines, bachelor of science (B.S.); in the College of Forestry, bachelor of science in forestry (B.S.F.); in the College of Pharmacy, pharmaceutical chemist (Ph.C.), and bachelor of science (B.S.); and in the School of Law, bachelor of laws (LL.B.).

GRADUATE DEGREES

Courses adapted to the needs of students who wish to earn the M. A. degree are offered in nearly all departments of the College of Arts and Sciences. In one department, Chemistry, courses are offered leading to the Ph.D. degree. Courses leading to the degree of M. S. are offered in the College of Engineering, the College of Mines and the College of Forestry. For further information concerning the requirements for graduate degrees, see the special bulletin of the college or school in which the courses are offered.

It is not the policy of the University at the present time to grant honorary degrees.

DEGREE WITH HONORS

A degree with honors may be conferred upon a student who, upon recommendation of the honors committee and upon vote of the faculty, may be declared worthy of unusual distinction.

Early in May each head of a department shall bring to the attention of the committee on honors such seniors making majors in his department as he thinks may be eligible for honors.

A student is not allowed to take honors in more than one subject.

THE UNIVERSITY NORMAL DIPLOMAS

The University is authorized by law to issue teachers' diplomas, valid in all public schools of the state, as described below. Candidates for these diplomas should register in the Department of Education as early as possible after the beginning of the sophomore year, and should consult with the department from time to time as to their work for the diploma and their preparation for teaching.

I. The University Five-Year Diploma, valid in all public schools in the state for a period of five years from date of issue, is granted on the following conditions:

1. Attainment of a bachelor's degree equivalent to that of the College of Arts and Sciences of the University of Washington. In

order to receive this diploma and the bachelor's degree, the candidate must present 132 hours instead of 128.

2. Completion of the teachers' course in the student's major subject.

3. Evidence of such general scholarship and personal qualities as give promise of success and credit in the profession of teaching; legible handwriting, good spelling, and correct English are indispensable. Active interest in the prospective work as teacher will be considered.

Recommendation to teach particular subjects will be granted to those who have made appropriate special preparation.

4. Completion of at least twelve hours in the Department of Education, including either course 1 or course 2 (History or Principles, 4 hours each) and eight hours selected from the following courses: 1, 3, 4, 6, 7, 8. The department reserves the right to adjust these requirements to the needs of individual cases.

II. The University Life Diploma is granted to candidates who fulfill the requirements for the University Five-Year Diploma, and also give satisfactory evidence of having taught successfully for at least twenty-four months.

SYSTEM OF GRADES

1. The following is the system of grades*:

A.....	Honor	
B.....		}Intermediate
C.....		
D.....		
E.....	Failed	
I.....	Incomplete	

(An incomplete is given only for excusable delinquencies.)

2. Candidates for the bachelor's degrees in the College of Arts and Sciences must receive grades of A, B, or C in three-fourths of the credits required for their respective degrees. This rule becomes operative in June, 1913, and does not apply to grades given before the year 1910-11.

*These grades correspond approximately to the old marking scheme as follows: A, 100-96; B, 95-86; C, 85-76; D, 75-70; E, 70-0.

SUMMARY OF ENROLLMENT

BY COLLEGES AND SCHOOLS

Graduate School	80
College of Arts and Sciences.....	1,403
College of Engineering.....	366
Chemical Engineering	35
Civil Engineering	151
Electrical Engineering	115
Mechanical Engineering	65
College of Forestry.....	71
School of Law.....	214
College of Mines.....	68
College of Pharmacy.....	82
Foresters' Short Course (three-months' course).....	37
Miners' Short Course (three-months' course).....	20
Total.....	2,341

BY CLASSES

Graduate Students	80
Seniors and Third Year Law.....	211
Juniors and Second Year Law.....	254
Sophomores and First Year Law.....	549
Freshmen	739
Special, Arts and Sciences.....	106
Special, Engineering	34
Special, Forestry	7
Special, Law	66
Special, Mining	5
Special, Pharmacy	28
Foresters' Short Course.....	37
Miners' Short Course.....	20
Extension, Arts and Sciences.....	205
	2,341
Summer Session of 1911.....	373
	2,714
Deduct Summer Students now attending University.....	82
Total.....	2,632

UNIVERSITY OF ILLINOIS

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PRESIDENT'S OFFICE

The Bulletin of the University of Washington includes the following publications:

THE CATALOGUE

Bulletins of

COLLEGE OF ARTS AND SCIENCES

COLLEGE OF ENGINEERING

COLLEGE OF FORESTRY

SCHOOL OF LAW

COLLEGE OF MINES

COLLEGE OF PHARMACY

GRADUATE SCHOOL

SUMMER SESSION

GENERAL INFORMATION

Requests for Bulletins, or for general information in regard to the University, and all credentials and correspondence relative to admission or advanced standing should be addressed to

THE RECORDER

University of Washington

Seattle, Washington

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1913/14

BULLETIN

University of Washington

SERIES I

APRIL, 1913

NO. 72—PART 8

College of Mines

1913—1914



SEATTLE, WASHINGTON

Published Quarterly by the University
1913

Entered as second class matter at Seattle, under the act of July 16, 1894



UNIVERSITY CALENDAR

1912-1913

Campus day.....	Friday, May 2
Junior day.....	Saturday, May 10
Memorial day (holiday).....	Friday, May 30
Semester examinations.....	Monday, June 9 to Friday June 13
Baccalaureate Sunday.....	June 15
Class day and President's reception.....	Monday, June 16
Alumni day.....	Tuesday, June 17
Commencement.....	Wednesday, June 18
Summer session begins.....	Monday, June 23
Summer session closes.....	Friday, August 1

1913-1914

FIRST SEMESTER.

Examinations for admission....	Friday and Saturday, Sept. 12-13
Registration days.....	Monday and Tuesday, September 15-16
Recitations begin	Wednesday, September 17
President's annual address.....	10 o'clock Friday, September 19
Thanksgiving vacation....	{ Wednesday, November 26, 6 p. m., to Monday, December 1, 8 a. m.
Christmas vacation.....	{ Friday, December 19, 6 p. m., to Monday, January 5, 8 a. m.
Semester examinations..	{ Monday, Tuesday, Wednesday, Thurs- day, Friday, January 26, 27, 28, 29, 30

SECOND SEMESTER

Registration day.....	Monday, February 2
Recitations begin.....	Tuesday, February 3
Spring vacation.....	{ Friday, April 3, 6 p. m. to Monday, April 13, 8 a. m.
Campus day.....	Friday, May 1
Junior day.....	Saturday, May 9
Memorial day (holiday).....	Saturday, May 30
Semester examinations.....	Monday, June 8, to Friday, June 12
Baccalaureate Sunday.....	June 14
Class day and President's reception.....	Monday, June 15
Alumni day.....	Tuesday, June 16
Commencement.....	10 o'clock, Wednesday, June 17

THE BOARD OF REGENTS

HON. HOWARD G. COSGROVE, President, term expires 1915..Seattle
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HON. CHAS. P. SPOONER, term expires 1914.....Seattle
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HON. A. L. ROGERS, term expires 1916.....Waterville
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WILLIAM MARKHAM, Secretary of the Board.

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THE UNIVERSITY

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EDWARD N. STONE, A. M., Recorder.
EDWIN B. STEVENS, A. M., Secretary to the President.
ISABELLA AUSTIN, A. B., Dean of Women.

THE SCHOOLS AND COLLEGES

ARTHUR SEWALL HAGGETT, PH. D., Dean of the College of Liberal Arts, Administration Building and Denny Hall.
ALMON HOMER FULLER, M. S., C. E., Dean of the College of Engineering, Engineering Building.
MILNOR ROBERTS, A. B., Dean of the College of Mines, Mines Building.
CHARLES WILLIS JOHNSON, PH. C., PH. D., Dean of the College of Pharmacy, Bagley Hall.
JOHN THOMAS CONDON, LL. M., Dean of the School of Law, Law Building.
HUGO WINKENWERDER, M. F., Dean of the College of Forestry, Good Roads Building.
J. ALLEN SMITH, PH. D., Dean of the Graduate School, Denny Hall.
HENRY LANDES, A. M., Dean of the College of Science, Science Hall.
FREDERICK ELMER BOLTON, PH. D., Dean of the School of Education, Education Building.

EXTENSION

EDWIN AUGUSTUS STAET, A. M., Director, Administration Building.

THE LIBRARY

WILLIAM E. HENRY, A. M., Librarian, Library Building.

COLLEGE OF MINES

FACULTY.

- THOMAS FRANKLIN KANE, PH. D., Johns Hopkins, PRESIDENT.
- MILNOR ROBERTS, A. B., Stanford, Professor of Mining Engineering and Metallurgy, DEAN.
- HENRY LANDES, A. M., Harvard, Professor of Geology and Mineralogy.
- *ALMON HOMER FULLER., M. S., C. E., Lafayette, Professor of Civil Engineering.
- JOHN THOMAS CONDON, L. L. M., Northwestern, Professor of Law.
- HORACE BYERS, PH. D., Johns Hopkins, Professor of Chemistry.
- TREVOR KINCAID, A. M., Washington, Professor of Zoology.
- FREDERICK ARTHUR OSBORN, PH. D., Michigan, Professor of Physics.
- ROBERT EDOUARD MORITZ, PH. N. D., Strassburg, Professor of Mathematics and Astronomy.
- CARL EDWARD MAGNUSSON, PH. D., E. E., Wisconsin, Professor of Electrical Engineering.
- EVERETT OWEN EASTWOOD, C. E., A. M., Virginia, Professor of Mechanical Engineering.
- D. C. HALL, PH. B., M. D., Sc. M., Chicago, Professor of Physical Training.
- E. J. McCAUSTLAND, B. C. E., M. C. E., Cornell, Professor of Civil Engineering.
- CHARLES CHURCH MORE, M. S., C. E., Lafayette, Associate Professor of Civil Engineering.
- HENRY KREITZER BENSON, PH. D., Columbia, Professor of Chemistry.
- JOSEPH DANIELS, S. B., M. S., Lehigh, Assistant Professor of Mining Engineering and Metallurgy.
- VANDERVEER CUSTIS, PH. D., Harvard, Assistant Professor of Economics.
- FRANK MARION MORRISON, A. B., Michigan, Assistant Professor of Mathematics.
- LOREN DOUGLAS MILLIMAN, A. B., Michigan, Associate Professor of English.

*Absent on leave during 1912-13.

- GEORGE SAMUEL WILSON, B. S., Nebraska, Assistant Professor of Mechanical Engineering.
- CHARLES M. HARRIS, C. E., Cornell, Assistant Professor of Civil Engineering.
- E. A. LOEW, B. S., Wisconsin, Assistant Professor of Electrical Engineering.
- CLARENCE RAYMOND COREY, E. M., Montana, Instructor in Mining Engineering and Metallurgy.
- HENRY LOUIS BRAKEL, A. M., Washington, Instructor in Physics.
- FRANK EDWARD JOHNSON, E. E., Minnesota, Instructor in Electrical Engineering.
- GEORGE IRVING GAVETT, B. S., C. E., Assistant Professor in Mathematics.
- CHARLES EDWARD WEAVER, PH. D., Assistant Professor in Geology.
- JOHN W. MILLER, B. S., Instructor in Civil Engineering.
- CHARLES EDWARD NEWTON, E. M., Instructor in Civil Engineering.
- SAMUEL THOMAS BEATTIE, Instructor in Woodwork.
- ALBERT R. SHERMAN, Assistant in Metallurgy.
- JAMES M. McDONALD, Assistant in Mining.
- OLIVER P. SEARING, Assistant in Stock Room.
- HARVEY L. GLENN, B. S., Lecturer on Assaying of Bullion.
- ROBERT F. McELVENNY, E. M., Lecturer on Copper Smelting.
- GEORGE BATES HARRINGTON, S. B., Mass. Inst. Tech., Lecturer on the Economics of Mining.
- DAVID C. BOTTING, State Coal Mine Inspector, Lecturer on Mine Regulations.

ADMISSION TO THE FRESHMAN CLASS

To be admitted to the freshman class, students must either (a) pass an examination based on a four-year course amounting in the aggregate to fifteen units, or (b) complete a course of the same length in an accredited school.

The requirements for admission to the freshman class of the College of Mines for curricula I, II, III and IV, leading to the degrees of bachelor of science in mining engineering, in geology and mining, in metallurgical engineering or in coal mining engineering are as follows:

	Units
† English	4
Algebra	1½

†A student presenting two units of foreign language may be admitted with three instead of four units of English.

Plane geometry	1
Solid geometry	$\frac{1}{2}$
Physics	1
Chemistry	1
One foreign language.....	2
History, American preferred.....	1
Or United States history, $\frac{1}{2}$; civics, $\frac{1}{2}$.	
Elective	3
<hr/>	
Total.....	15

For curriculum leading to the degree of bachelor of science (B. S.), (V) the entrance requirements are the same as the above with the exception that chemistry (one unit) is not a fixed requirement; four instead of three units elective are allowed.

DEGREES

The four-year curricula in the College of Mines lead to the following degrees: Curriculum I, bachelor of science in mining engineering; curriculum II, bachelor of science in geology and mining; curriculum III, bachelor of science in metallurgical engineering; curriculum IV, bachelor of science in coal mining engineering.

In addition to the above, curriculum V, which leads to the degree of bachelor of science (B. S.), is offered. The entrance requirements for curriculum V are less technical than for the other curricula and the training given by it is broader. Students who graduate in this curriculum are advised to spend an additional year in study and research according to the schedule given for the degree of master of science in mining engineering (M. S. in Min. E.). A new curriculum in coal mining engineering is offered.

The degree of engineer of mines (E. M.) is given to graduates in mining engineering who have practiced their profession for at least three years, and who present a satisfactory thesis. Graduates in metallurgy may receive the degree of metallurgical engineer (Met. E.) under similar conditions.

MINING AND METALLURGICAL INDUSTRIES AVAILABLE FOR STUDY

Excellent opportunities for becoming familiar with mining and metallurgical operations are open to students in the College of Mines. The amount of time available during the college year for

this purpose is not great and even by using the summer vacations it is impossible for a student to cover the whole field of local industries included in his chosen profession.

Mining machinery of the best type is in operation within easy reach of the University. Much of the heavy mining machinery used in the neighboring states and Alaska is built in the city of Seattle, while the patented machines, such as drills and concentrating tables of all makes are kept in stock and as working exhibits by the firms that supply the North Pacific coast regions. The application of hydraulic mining methods to city grading is being carried on locally on a very large scale and with the most approved pumping and piping appliances and methods. Equally important to the mining engineer are the operations of the steam shovels, which are used largely now in iron, copper and gold mining. The engineers in charge of these plants have given the mining students every opportunity to become familiar with the methods of planning and carrying on the work, and the same statement applies to the mine operators throughout the state.

A brief list of the other available works of interest includes coal mines, with the largest production west of the Rocky mountains; metal mines of gold, silver, copper, arsenic, antimony, iron, etc.; cement plants, glass works, several stone quarries and dressing works; clay mines, clay and pottery works; gravel and sand pits with large production and approved methods; a region of varied geology with many economic minerals; the Tacoma and Everett smelters and refineries; the U. S. assay office; the Irondale steel plant of the Western Steel Corporation, and several plants engaged in metallurgical work.

MINING SOCIETY

The Mining Society, affiliated with the American Institute of Mining Engineers, has a membership composed of upperclassmen, graduate students and three sophomores, chosen for the excellence of their records in actual mining. At the monthly meetings of the society addresses are made by prominent mining engineers, and papers descriptive of their summer work are presented by the student members. The officers for 1912-13 are, Oliver P. Searing, president; Fred R. Porter, vice-president; J. E. Berg, secretary; J. M. McDonald, treasurer; A. R. Sherman, corresponding secretary.

UNITED STATES MINE RESCUE TRAINING STATION

The United States Mine Rescue Training Station, operated in connection with the College of Mines, occupies a separate building. The "smokeroom," fitted with track and car, overcast airway, doghole, and smudge floors, is the largest of its kind in the country, measuring 25 by 50 feet.

Several sets of the Draeger oxygen apparatus and pulmotor are kept on hand for practice as well as for use in mine rescue work. The purpose of the station is to train miners in the use of oxygen helmets, which are used in cases of mine fires and explosions in both coal and metal mines. From ten days to two weeks' time is required for the course of training. The applicant is taught the construction of the apparatus and is required to wear it for four hours each day, in two periods of two hours each. The practice is carried on in a room filled with gas which cannot be breathed without immediate danger, and the work to be performed is the same as that which would be required in actual mining operations or rescue work. The smokeroom represents a portion of a mine, and is equipped with mine car, track, overcast, timbers and brick. Applicants who have completed the course of training receive a certificate from the U. S. Bureau of Mines.

INSTRUCTION FOR COAL MINING MEN

Miners taking the rescue training also receive instructions in the College of Mines on the subjects of mine gases, explosions, and the origin and distribution of Pacific Coast and Alaska coals. Laboratory experiments are carried on to show the methods of analyzing coals and determining the uses to which they may be put. The methods of testing for permissible explosives at the Pittsburg Station and the safe methods of charging, tamping and firing are explained. Special lectures are given by State Mine Inspector Botting, Assistant Inspector Corey and government engineers.

CURRICULA IN THE COLLEGE OF MINES

I. CURRICULUM IN MINING ENGINEERING

FRESHMAN YEAR

FIRST SEMESTER	Hours	SECOND SEMESTER	Hours
Mathematics 1a	4	Mathematics 2a	4
Chemistry 1a	4	Chemistry 2a	4
Civil engineering 1, 3.....	6	Civil engineering 4	2
English 1a	2	Civil engineering 20.....	4
Mechanical engineering 1..	2	English 2a	2
Drill	2	Mechanical engineering 9..	2
		Drill	2
	16+3		16+4

SOPHOMORE YEAR

Geology 1a	4	Geology 9	4
Mathematics 3a	4	Mathematics 4a	4
Physics 1a.....	4	Chemistry 9	4
Physics 1b	2	Physics 2a	4
Civil engineering 28	3	Physics 2b	1
Drill	2	Drill	2
	17+2		17+2

JUNIOR YEAR

Mining 4	2	Mining 9	1
Mathematics 5a	2	Metallurgy 2	4
Metallurgy 1	4	Geology 17	4
Civil Engineering 41.....	4	Civil engineering 50.....	4
Geology 13	4	Economics 1a	3
Mechanical engineering 3..	2	Mining practice in summer	
Mining 21	1	vacation	
	16+3		16

SENIOR YEAR

Mining 1	4	Mining 2	4
Mining 3	2	Mining 22	1
Mining 6	1	Mining 7	1
Metallurgy 5	3	Mining 8	2
Metallurgy 7	3	Geology 18	4
Metallurgy 13	3	Geology 21	1
		Electrical engineering 6... 3	
	16		16

II. CURRICULUM IN GEOLOGY AND MINING

FRESHMAN YEAR

	Hours		Hours
Mathematics 1a	4	Mathematics 2a	4
Chemistry 1a	4	Chemistry 2a	4
Civil engineering 1, 3.....	6	Civil engineering 4.....	2
English 1a	2	Civil engineering 20.....	4
Mechanical engineering 1..	2	English 2a	2
Drill	2	Mechanical engineering 9..	2
		Drill	2
	<hr/>		<hr/>
	16+4		16+4

SOPHOMORE YEAR

Geology 1a	4	Geology 9	4
Mathematics 3a	4	Mathematics 4a	4
Physics 1a.....	4	Chemistry 9	4
Physics 1b	2	Physics 2a	4
Civil engineering 28.....	3	Physics 2b	1
Drill	2	Drill	2
	<hr/>		<hr/>
	17+2		17+2

JUNIOR YEAR

Mining 4	2	Mining 9	1
Metallurgy 1	4	Metallurgy 2	4
Metallurgy 3	2	Metallurgy 9	2
Geology 13	4	Metallurgy 12	3
Geology 20	1	Geology 17	4
Civil engineering 23	3	Economics 1a	3
Mechanical engineering 3..	2	Geology or mining practice	
Mining 21	1	in summer vacation	
	<hr/>		<hr/>
	16+3		17

SENIOR YEAR

Mining 1	4	Mining 2	4
Mining 6	1	Mining 22	1
Metallurgy 5	3	Mining 7	1
Metallurgy 7	3	Mining 8	2
Geology 20	1	Metallurgy 4 or 6.....	3
Geology 19	4	Geology 18	4
	<hr/>	Geology 21	1
	16		<hr/>
			16

III. CURRICULUM IN METALLURGICAL ENGINEERING

FRESHMAN YEAR

	Hours		Hours
Mathematics 1a	4	Mathematics 2a	4
Chemistry 1a	4	Chemistry 2a	4
Civil engineering 1, 3.....	6	Civil engineering 4.....	2
English 1a	2	Civil engineering 20.....	4
Mechanical engineering 1..	2	English 2a	2
Drill	2	Mechanical engineering 9..	2
		Drill	2
	<hr/>		<hr/>
	16+4		16+4

SOPHOMORE YEAR

Geology 1a	4	Geology 9	4
Mathematics 3a	4	Mathematics 4a	4
Physics 1a	4	Chemistry 9	4
Physics 1b	2	Physics 2a	4
Civil engineering 28.....	3	Physics 2b	1
Drill	2	Drill	2
	<hr/>		<hr/>
	17+2		17+2

JUNIOR YEAR

Metallurgy 1	4	Mining 9	1
Metallurgy 10	3	Metallurgy 2	4
Civil engineering 41.....	4	Metallurgy 4	3
Economics 1a	3	Civil engineering 42.....	3
Mechanical engineering 3...	2	Civil engineering 50.....	4
Mining 21	1	Mechanical engineering 4..	2
		Metallurgical practice in summer vacation	
	<hr/>		<hr/>
	16+1		15+2

SENIOR YEAR

Mining 1	4	Mining 22	1
Mining 6	1	Mining 2	4
Metallurgy 3	2	Mining 8	2
Metallurgy 5	3	Mining 7	1
Metallurgy 7	3	Metallurgy 6	2
Metallurgy 11	1	Metallurgy 8	3
Metallurgy 13	3	Geology 18	4
	<hr/>		<hr/>
	17		17

IV. CURRICULUM IN COAL MINING ENGINEERING

FRESHMAN YEAR

	Hours		Hours
Mathematics 1a	4	Mathematics 2a	4
Chemistry 1a	4	Chemistry 2a	4
Civil engineering 1, 3.....	6	Civil engineering 4.....	2
English 1a	2	Civil engineering 20.....	4
Mechanical engineering 1..	2	English 2a	2
Drill	2	Mechanical engineering 9..	2
		Drill	2
	<hr/>		<hr/>
	16+4		16+4

SOPHOMORE YEAR

Geology 1a	4	Geology 9	4
Mathematics 3a	4	Mathematics 4a	4
Physics 1a	4	Chemistry 9	4
Physics 1b	2	Physics 2a	4
Civil engineering 28.....	3	Physics 2b	1
Drill	2	Drill	2
	<hr/>		<hr/>
	17+2		17+2

JUNIOR YEAR

Mathematics 5a	2	Metallurgy 2	4
Metallurgy 1	4	Civil engineering 50.....	4
Civil engineering 41.....	4	Economics 1a	3
Geology 16	3	Mining 9	1
Mining 4	2	Geology 21	1
Mechanical engineering 3..	2	Mining 12	2
Mining 21	1	Mining 13	2
	<hr/>		<hr/>
	15+3		17

SUMMER PRACTICE IN COAL MINING

SENIOR YEAR

Mining 1	4	Mining 20	4
Mining 3	2	Mining 7	1
Mining 6	1	Mining 8	2
Mining 15	3	Electrical engineering 6...	3
Mining 14	2	Mining 11	2
Mechanical eng. 21 and 40..	4	Metallurgy 14	3
		Mining 16	2
	<hr/>		<hr/>
	16		17

V. CURRICULUM IN MINING ENGINEERING

Leading to the degree of Bachelor of Science.

FRESHMAN YEAR

	Hours		Hours
Mathematics 1a	4	Mathematics 2a	4
Chemistry 1	4	Chemistry 2	4
English 1a	2	Civil engineering 3.....	4
Modern foreign language... 4		Modern foreign language... 4	
Civil engineering 1	2	Mechanical engineering 9..	2
Mechanical engineering 3... 2		Drill	2
Drill	2		
	<hr/> 16+4		<hr/> 16+4

SOPHOMORE YEAR

Mathematics 3a	4	Mathematics 4a	4
Chemistry 8b	4	Physics 1a	4
Civil engineering 4.....	2	Physics 1b	2
Modern foreign language... 4		Chemistry 9	4
Mechanical engineering 3... 2		Civil engineering 20.....	4
English 2a	2	Drill	2
Drill	2		
	<hr/> 16+4		<hr/> 18+2

JUNIOR YEAR

Mathematics 5a	2	Mining 9	1
Physics 2a	4	Metallurgy 1	4
Physics 2b	1	Electrical engineering 6...	3
Geology 1a	4	Civil engineering 41.....	4
Civil engineering 28	3	Geology 9	4
Mining 4	2	Mining practice in summer vacation	
	<hr/> 16		<hr/> 16

SENIOR YEAR

Metallurgy 2	4	Mining 2	4
Mining 1	4	Mining 7	1
Civil engineering 42.....	4	Metallurgy 8	2
Geology 13	4	Geology 17	4
		Geology 21	1
		Economics 1a	3
	<hr/> 16		<hr/> 15

GRADUATE COURSE IN MINING ENGINEERING

Following course V and leading to the degree of Master of Science in Mining Engineering.

	Hours		Hours
Mining 10	3	Mining 22	1
Mining 6	1	Mining 6	1
Metallurgy 7	3	Mining 7	1
Mining 3	2	Mining 8	2
Metallurgy 13	3	Metallurgy 4	3
Elective, engineering	4	Geology 18	4
Mining 21	1	Elective, engineering	3
		Mining 11	2
	<hr/>		<hr/>
	17		17

Equivalent courses in Coal Mining Engineering may be substituted for those listed above.

The degree of Master of Science in Mining Engineering will also be conferred upon graduates of this College or of other mining colleges of the first class who complete a year (32 credit hours) of graduate work, including a satisfactory thesis, with the grade of A or B. The candidate must also pass a formal examination open to all members of the faculty. The selection of work for this degree must in each case be approved by the head of the department in which the student majors.

VI. SHORT SESSION FOR MINING MEN

The seventeenth annual Short Session for mining men will open on January 6th, 1914, continuing until April 2d. During that period each year twelve of the instructors in mining engineering offer a course for the benefit of persons who are interested in prospecting, mining, smelting, clay or metal-working. Admission to the classes is without examination. Instruction is given by lectures, laboratory exercises, and visits to mines and plants in operation. The past experience and future aims of each student are taken into consideration, and the character of his work arranged accordingly.

No preparation is needed for this course. Many practical men with an interest in some branch of mining but without much education have obtained satisfactory results from the course; others with a college education and mining experience have gained much up-to-date training and information. Practically all the students attend the following subjects: Mining, field trips, mineralogy, geology, mining law; in addition to these subjects, fire assaying and general chemistry are taken by many of the quartz miners,

while the placer men substitute placer mining and surveying. Subject 3 cannot be taken without subjects 5 and 6. Students who satisfactorily complete a course of study are given a certificate stating the amount and character of work done. For students who return a second year, a special course is arranged in continuation of their previous work.

The advantages of the University laboratories and libraries are open to all. Students may board and room at the dormitories or elsewhere, as preferred. There are no charges, except for material used. Deposits are made to cover the actual cost of supplies drawn by each student, the balance of the deposit being returned at the end of the course. All deposits are made at the beginning of the course.

SUBJECTS

A. MINING. Lectures on prospecting, development, mining systems, timbering, mine transportation, pumping, ventilation, and hydraulic mining. Practice with stamp-milling and concentrating machinery, testing of ores, etc. Two lectures and one afternoon a week. Professor ROBERTS and Assistant Professor DANIELS.

B. FIELD TRIPS. An outline study of the operations at neighboring mines, mills, and smelters; geological field studies, followed by laboratory practice on the rocks and minerals found. Saturdays. Professor ROBERTS and Assistant Professor DANIELS.

C. FIRE ASSAYING. Lectures on sampling, preparing ores for assay, furnaces, fuels, reagents, and the fire assay of gold, silver, lead, and tin ores. The laboratory work includes the testing of reagents, and the assaying of various ores. One lecture and three afternoons a week in laboratory. Deposit, fifteen dollars. Mr. COREY.

D. METALLURGY. A study of the principles of metallurgy for the benefit of those who are engaged in the metal trades or in the mining of ores requiring smelter treatment. Two lectures and one afternoon a week. Deposit, five dollars. Mr. COREY.

CHEMISTRY 1d. GENERAL CHEMISTRY AND QUALITATIVE ANALYSIS. Laboratory practice in the determination of the common elements. Three lectures a week, and Saturday laboratory. Deposit, ten dollars. Professor BENSON.

GEOLOGY B. MINERALOGY. Instruction and practice in blowpipe analysis, with lectures upon the common minerals, and practice in the identification of minerals by field tests. Twice a week. Deposit, two dollars. Assistant Professor WEAVER.

GEOLOGY. Lectures on the elements of geology, the common varieties of rock, metalliferous vein and ore deposits, etc. Twice a week. Assistant Professor WEAVER.

MINING LAW. A series of lectures on the mining laws of the United States and Alaska. Illustrated by drawings and mine maps. Once a week. Assistant Professor DANIELS and special lectures.

CIVIL ENG. 19. SURVEYING. Instruction and field practice in the use of simple instruments for making underground and surface surveys; the elements of drawing, lettering, sketch-mapping and field notes; the rules governing mineral surveys. Two lectures and two afternoons a week. Mr. NEWTON.

CIVIL ENG. 54. HYDRAULIC MINING. The elements of hydraulics; the flow of water in pipes, flumes and ditches; the methods and costs of placer mining in its various forms. Two lectures a week. Professor McCAUSTLAND.

MECH. ENG. 3. FORGE. Practice in sharpening and tempering drill steel and picks; systematic training in the making and care of fires, and the application of various heats, drawing, punching, riveting, bending, twisting, upsetting, welding iron and steel, and making and tempering machine tools. Deposit, two dollars. One afternoon a week. Mr. KANE.

MECH. ENG. 9. MINE TIMBER FRAMING. Shop work in the cutting, framing and erection of various types of timbers employed in mining operations. Deposit, two dollars. One afternoon a week. Mr. BEATTIE.

MINING 21. COAL MINING AND RESCUE TRAINING. For a description of the short courses in coal mining, first aid to the injured and rescue training, see under "Mine Rescue Training Station," page 9. Assistant Professor DANIELS, State Mine Inspector BOTTING and Government Engineers.

DEPARTMENTS OF INSTRUCTION**MINING ENGINEERING AND METALLURGY**

(Mines Building)

PROFESSOR ROBERTS, ASSISTANT PROFESSOR DANIELS, MR. COREY; LECTURERS, MR. MC ELVENNY, MR. HARRINGTON, MR. GLENN; ASSISTANTS, MR. SHERMAN, MR. MC DONALD, MR. SEARING.

I. MINING ENGINEERING

Coal miners who are taking the ten days' course in the U. S. Mine Rescue Training Station are given daily instruction and laboratory demonstrations in the subjects of mine gases, ventilation, the origin and composition of coals, and coal analysis.

1. MINING. Four credits. First semester. Prerequisite, Senior standing. Professor ROBERTS.

Three lectures and one laboratory period. Lectures on mining, power generation, air compression, hoisting and transportation. Practice with air compressors, machine drills and mine equipment in laboratories and local plants.

2. ORE DRESSING. Four credits. Second semester. Prerequisite, Mining 3. Senior or graduate. Deposit, five dollars. Professor ROBERTS and Assistant Professor DANIELS, and Mr. McDONALD.

Two lectures and two laboratory periods. A detailed study of certain branches of ore dressing followed by a full test of ores by mill run checked by assays.

3. MILLING. Two credits. First semester. Prerequisite, Junior standing. Professor ROBERTS and Assistant Professor DANIELS, and Mr. McDONALD.

One lecture and one laboratory period. Lectures and mill practice in the principles of ore dressing.

4. MINE OPERATION. Two credits. First semester. Prerequisite, Junior standing. Professor DANIELS.

A general study of mine development and operation, considering particularly layout of plant, haulage, hoisting, pumping, etc. The Renton mine is studied in detail. Regular course of training under U. S. Bureau of Mines is required.

5. FIELD WORK. One credit. First semester. Professor ROBERTS, and Assistant Professor DANIELS.

One laboratory period (or its equivalent in total time required) and monthly seminar. Class or individual visits to a mine, mill, smelter, or engineering work, to be followed by a report on field notes and sketches.

6. THESIS OUTLINE. One credit. First semester. Professor ROBERTS, and Assistant Professor DANIELS, and Mr. COREY.

The outlining of the senior thesis, the gathering of material, study of references, making of drawings, maps, etc., in preparation for the work of the second semester. See mining 8. Senior or graduate.

7. MINE INSPECTION. One credit. Second semester. Professor ROBERTS, Assistant Professor DANIELS, and Mr. COREY.

Ten days in the second semester. An excursion of the senior class to a mine or mining district.

8. THESIS. Two credits. Second semester. Professor ROBERTS, Assistant Professor DANIELS and Mr. COREY.

A continuation of Mining 6. Weekly consultation and seminars.

9. JUNIOR EXCURSION. One credit. Second semester. Required for senior standing. Professor ROBERTS, Assistant Professor DANIELS, and Mr. COREY.

An excursion of the junior class to a mine or mining district. Sometimes made in connection with the senior excursion, mining 7.

10. MINING METHODS. Three credits. First semester. Senior or graduate. Professor ROBERTS.

Two lectures and one laboratory period. A detailed study of certain branches of mining.

11. MINE MANAGEMENT. Two credits. Second semester. Prerequisite, Senior or graduate standing. Professor DANIELS.

Two lectures. A study of the organization and administration of engineering plants, involving the keeping and interpretation of cost accounts, the efficiency of labor and methods, the financial, legal and social aspects of engineering operation.

12. COAL RESOURCES OF NORTH AMERICA. Two credits. Second semester. Two lectures. Prerequisite, Mining 4. Assistant Professor DANIELS.

The occurrence of coal in North America with especial reference to geographic and geologic distribution and structure; study of the various types of coals; classification of coals; commercial requirements of coals.

13. COAL MINING METHODS. Two credits. Second semester. Two lectures. Prerequisite, Mining 4. Assistant Professor DANIELS.

Methods of prospecting coal seams; determination of structure and content; methods of development and working, timbering, etc. A detailed study is made of a nearby mine.

14. MINE GASES AND VENTILATION. Two credits. First semester. Two lectures. Prerequisite, Mining 13. Assistant Professor DANIELS.

Composition and properties of mine gases, methods of testing. Lighting of mines. Principles of ventilation; ventilating machinery.

15. MINING PLANT. Three credits. First semester. Three drafting periods. Prerequisites, Mining 13, 14. Graduate. Assistant Professor DANIELS.

Design of plant and machinery employed in mining and preparing coal for market.

16. COAL MINING MACHINERY. Two credits. Second semester. Two lectures. Prerequisite, Senior standing. Graduate. Assistant Professor DANIELS.

Study of coal cutting machines, mine locomotives, fans, hoists, pumps, and tippie or breaker machinery with special reference to application to coal mining.

20. COAL WASHING. Four credits. Second semester. Two lectures and two laboratory periods. Prerequisite, Mining 3. Graduate. Assistant Professor DANIELS.

A detailed study of methods of preparing coal for market, together with laboratory tests and runs on various coal to determine best methods of preparation.

21. MINE RESCUE TRAINING. One credit. First semester. Twenty-five hours' instruction. Assistant Professor DANIELS.

Practice in the care and use of oxygen rescue apparatus, smoke-room training, and first-aid-to-the-injured work. Required of all students in the junior class.

22. MINING LAW. One credit. Second semester. Assistant Professor DANIELS and special lecturers.

A series of lectures on the mining laws of the United States and Alaska, dealing particularly with the subject from the standpoint of the prospector, mining engineer and geologist. Illustrated by diagrams and mine maps.

24. INDUSTRIAL ORGANIZATION. Two credits. Second semester. Assistant Professor DANIELS.

A study of the principles of industrial organization and scientific management, involving the consideration of handling labor and materials, methods of operation, cost keeping and performance records, interpretation of efficiency data.

II. METALLURGY

1. FIRE ASSAYING. Four credits. First semester. Prerequisite, Chemistry 9. Deposit, fifteen dollars. Mr. COREY, Mr. GLENN and Mr. SHERMAN.

One lecture and three laboratory periods. The testing of reagents, the crushing, sampling and assaying of ores, furnace and mill products for lead, silver, gold and tin; also, the assay of base and dore bullion.

2. GENERAL METALLURGY. Four credits. Second semester. Deposit, ten dollars. Professor ROBERTS, Mr. COREY and Mr. McELVENNY.

Two lectures and two laboratory periods. The properties of metals and alloys, fuels, refractory materials, furnaces and the extraction of the common metals from their ores. Visits to smelter.

3. METALLURGICAL FUELS. Two credits. First semester. Deposit, five dollars. Assistant Professor DANIELS.

One lecture and one laboratory period. The composition, manufacture and metallurgical uses of natural and prepared fuels; the methods and costs of coking, gas making, and coal briquetting. Furnace and calorimeter tests of various types of fuels.

4. COPPER AND LEAD. Three credits. Second semester. Mr. COREY.

Three lectures. The metallurgy of copper and lead, especially the methods of roasting, smelting and refining.

5. GOLD AND SILVER. Three credits. First semester. Mr. COREY. Two lectures and one laboratory period. Amalgamation, cyan-

iding, and chlorination of gold and silver ores. Complete tests checked by assays. Deposit, five dollars.

6. MINOR METALS. Three credits. Second semester. Two lectures and one laboratory period. Deposit, five dollars. Mr. COREY.

The metallurgy of zinc, antimony, tin, aluminum, nickel, etc.; a study of the plant required, the methods and costs of treatment.

7. WET ASSAYING. Three credits. First semester. Prerequisite, Chemistry 9. Deposit, ten dollars. Mr. COREY.

Technical methods for the determination of copper, lead, zinc, etc., in ores and furnace products, etc.

8. METALLURGICAL ANALYSIS. Three credits. Second semester. Prerequisite, Chemistry 9. Deposit, ten dollars. Mr. COREY.

Technical methods of analysis of coals, slags, and industrial products.

9. PYROMETRY AND ALLOYS. Two credits. Second semester. One lecture and one laboratory period. Deposit, three dollars. Mr. COREY.

Methods of measuring high temperatures. Union of metals by fusion, compression and electro-deposition; the behavior of metals and alloys under heat. Laboratory practice in thermal measurements, synthesis and testing of alloys.

10. METALLOGRAPHY. Two credits. First semester. One lecture and laboratory period. Deposit, three dollars. Assistant Professor DANIELS.

The constitution and microstructure of metals and alloys, especially iron and steel. The preparation and study of metal sections, photomicrography and the use of the microscope to aid in testing structural iron and steel.

11. METALLURGICAL PROBLEMS. One credit. First semester. Prerequisites, Chemistry 9, and Metallurgy 2. Mr. COREY.

Physical chemistry for the metallurgist, slag calculations, etc., illustrated by figures quoted from the present practice at a number of smelting plants.

12. REFRACTORIES. Three credits. Second semester. One lecture and two laboratory periods. Deposit, three dollars. Mr. COREY.

Methods of testing clays, refractory materials, cement-making materials.

13. DESIGN OF PLANT. Three credits. First semester. Three drafting periods. Senior or graduate. Professor ROBERTS and Assistant Professor DANIELS.

The designing of a piece of equipment or a structure for mining, milling or metallurgical purposes.

14. IRON AND STEEL. Three credits. Second semester. Three lectures. Assistant Professor DANIELS.

The metallurgy and manufacture of commercial iron and steel, with special reference to their properties and uses in engineering work.

THESIS. See Mining 6 and 8.

SUMMER FIELD WORK. See Mining 7 and 8.

SUBJECTS PRESENTED BY DEPARTMENTS IN OTHER COLLEGES OF THE UNIVERSITY

CHEMISTRY

(Bagley Hall)

1, 2. GENERAL CHEMISTRY. Four credits. The year. Text-books, Smith's College Chemistry and Laboratory Manual. Professor BYERS, Instructors and Assistants.

1a, 2a. GENERAL CHEMISTRY. Four credits. The year. Consists of two lectures and six laboratory hours per week. Text-books, Smith's General Chemistry, Smith's Laboratory Manual, and Byers and Knight's Qualitative Analysis. Prerequisite, one year high school chemistry. Professor BYERS, Assistant Professor ROSE and Assistants.

1b. GENERAL CHEMISTRY. Four credits. Second semester. Repetition of 1a. Assistant Professor ROSE.

Strong students or those carrying light course will be permitted to elect this course without the prerequisite high school course; but to satisfy the required work of the engineering curricula, such students must elect some other four-hour course in the department of chemistry.

2b. GENERAL CHEMISTRY. Four credits. First semester. Continuation of 1b. Assistant Professor ROSE.

1d. PROSPECTOR'S COURSE. Four credits. Deposit, ten dollars. Professor BENSON.

For miners who may enter January 1, and will continue to April 1. Does not require previous knowledge of chemistry, and will be merged into a course of qualitative analysis. The text is Brownlee.

9-9. QUANTITATIVE ANALYSIS. Four credits. Either semester. Gravimetric and volumetric analysis. Olsen's Quantitative Analysis. Twelve laboratory hours and one recitation per week. Professor BENSON.

CIVIL ENGINEERING

(Engineering Building)

1. ENGINEERING DRAWING. Two credits. The year. All freshman engineers. Prerequisites, plane geometry. Assistant Professor HARRIS.

Linear drawing, Roman and Gothic capital letters; free hand lettering.

3. ENGINEERING DRAWING. Four credits. The year. All freshman engineers. Prerequisites, solid geometry, preceded or accompanied by drawing 1. Assistant Professor HARRIS, Mr. GLEASON, Mr. MUEHLSTEIN, Mr. WERNECKE, Mr. STRANDBERG and Mr. MAY.

The elements of descriptive geometry, including the principles of shades, shadows and perspective.

4. ENGINEERING DRAWING. Two credits. The year. All freshman engineers. Prerequisite, 3.

Continuation of drawing 3. Problems and tracing.

20. ELEMENTARY PLANE SURVEYING. Four credits. The year. All freshman engineers. Prerequisites, Math. 1a and C. E. 1. Laboratory deposit, three dollars. Mr. GLEASON, Mr. NEWTON, Mr. MUEHLSTEIN and assistants.

Theory and use of chain, compass, transit and level. Adjustment of instruments. United States Public Land surveys. Maps and computation of areas.

23. TOPOGRAPHIC SURVEYING. Three credits. The year. Junior Min. E. Prerequisites, Math. 3a and C. E. 21. Laboratory deposit, three dollars. Mr. MILLER.

Base line measurement. Reading and adjusting and computing triangulation systems. Topographic surveying, including plane-table, photography and cartography.

28-28. MINE SURVEYING. Three credits. Either semester. Sophomore mining engineers. Prerequisite, C. E. 20. Laboratory deposit, three dollars. Mr. NEWTON.

Surface and underground practice. Observations for meridian. Topography. Mining claim surveys. Plane triangulation. Tunnel and vertical shaft work and connections. Mapping.

41-42. MECHANICS 41, four credits, the year. 42, three credits, the year. All junior engineers. Prerequisites, Math. 4a, physics 1a. Professor MORE, Acting Assistant Professor STEVENS, Mr. MUEHLSTEIN and Mr. WERNECKE.

(NOTE: Students entering this course must give satisfactory evidence of a *working knowledge* of the fundamentals of arithmetic, algebra, geometry and trigonometry.)

Statics, dynamics and mechanics of materials.

50. HYDRAULICS. Four credits. The year. All junior engineers. Prerequisite, preceded or accompanied by 42. Assistant Professor HARRIS and Mr. STRANDBERG.

Flow of water through pipes and orifices, over weirs and in open channels; energy, impulse and reaction of jets with application to impulse wheels. Review of hydrostatics.

54. HYDRAULIC MINING. (Short session in mining, January-March). Professor McCAUSTLAND.

A course of two lectures per week on the theory and practice of hydraulic mining.

ELECTRICAL ENGINEERING

(Engineering Building)

6. ELECTRICAL ENGINEERING. Three credits. Second semester. For students in mining engineering. Mr. KAYLOR.

The application of electricity to mining.

ENGLISH

(Auditorium)

1a-2a. FRESHMAN COMPOSITION. Two credits. The year. An adaptation of 1-2 for students of engineering. Eight sections.

GEOLOGY

(Science Hall)

1a. GENERAL GEOLOGY. Four credits. First semester. For engineering and mining students. Professor LANDES.

9. MINERALOGY. Four credits. Second semester. Two laboratory periods. Descriptive and determinative mineralogy. Laboratory fee, two dollars. Mr. CULVER.

13. OPTICAL CRYSTALLOGRAPHY. Four credits. First semester. Two recitations and two laboratory periods per week. Laboratory fee of two dollars. Dr. WEAVER.

16. PETROLOGY. Three credits. First semester. One recitation and two laboratory periods. Laboratory deposit, two dollars. For coal mining engineers. Assistant Professor WEAVER.

A study of the principal types of rocks and practice in their determination by field methods.

17. PETROGRAPHY. Four credits. Second semester. Prerequisites, 1a, 9, 13. Assistant Professor WEAVER.

A study of the distinguishing characteristics of the different groups and species of rocks with practice in their determination by modern petrographical methods.

18. ECONOMIC GEOLOGY. Four credits. Second semester. Four recitations per week. Professor LANDES.

19. PALEONTOLOGY. Four credits. First semester. Three recitations and one laboratory period per week. Chiefly for students in geology and mining. Assistant Professor WEAVER.

20. FIELD WORK. One credit. First semester. Hours to be arranged.

21. FIELD WORK. One credit. Second semester. Hours to be arranged. Professor LANDES, Assistant Professor SAUNDERS and WEAVER.

B. PROSPECTOR'S GEOLOGY AND MINERALOGY. Lectures, recitations, and laboratory work in general geology and mineralogy. This course is given in January, February, and March, to the students in the short course for mining men. Assistant Professor WEAVER.

MATHEMATICS

(Science Hall)

A-B. SOLID GEOMETRY. Two credits. The year. Prerequisite, Plane Geometry.

Required during the freshman year of all students in the colleges of Engineering, Forestry and Mines who do not offer solid geometry for admission.

1a. TRIGONOMETRY AND ALGEBRA. Four credits. First or second semester. Prerequisites, same as for Math 1-2.

Primarily for students in the colleges of Engineering, Forestry, and Mines. The elements of plane trigonometry and supplementary work in algebra equivalent to one hour per week.

2a. ANALYTICAL GEOMETRY AND ALGEBRA. Four credits. First or second semester. Prerequisite, Math 1a.

Primarily for students in the colleges of Engineering, Forestry, and Mines. The elements of analytical geometry and supplementary work in algebra equivalent to one hour per week.

3a. CALCULUS FOR ENGINEERS. Four credits. First or second semester.

4a. CALCULUS FOR ENGINEERS. Four credits. First or second semester.

Continuation of Math. 3a.

5a. APPLICATION OF THE CALCULUS FOR ENGINEERS. Two credits. First or second semester. First semester, 3 sections, W., F. at 10; T., Th. at 10; M., W. at 5. Second semester, W., F. at 4. Prerequisite, Math. 4a.

MECHANICAL ENGINEERING

(Office, Engineering Building)

1. CARPENTRY AND WOODTURNING. Two credits. The year. Mr. BEATTIE and Mr. THERKELSEN.

3. FORGE AND FOUNDRY. Two credits. The year. Mr. KANE.

4. MACHINE WORK. Two credits. The year. Mr. KANE.

9. MINE TIMBER FRAMING. Two credits. Second semester. Mr. BEATTIE, Assistant Professor DANIELS.

MILITARY SCIENCE AND TACTICS

(Office, The Armory)

EDWARD E. MC CAMMON, FIRST LIEUTENANT THIRD INFANTRY, U. S. A.
COMMANDANT

A course of two years in military training is required. All able-bodied male students (except those from foreign countries, not intending to become naturalized) must take the course, which by regulation of the University is required during the first and

second years. Three hours a week are devoted to military training, for which two credits are given each semester.

PHYSICS

(Basement, Denny Hall)

1a. MECHANICS AND WAVE MOTION. Four credits. First or second semester. This course must be accompanied by 1b. Professor OSBORN.

2a. LIGHT, HEAT, ELECTRICITY. Four credits. First or second semester. This course must be accompanied by 2b. Professor BRAKEL.

1b. PHYSICS MEASUREMENT. Two credits. First or second semester. One four-hour laboratory period. Six dollars deposit per year. Mr. VORIS.

2b. PHYSICS MEASUREMENT. One credit. First or second semester. One three-hour laboratory period. Mr. VORIS.

POLITICAL AND SOCIAL SCIENCE

(Denny Hall)

1a. ELEMENTS OF ECONOMICS. Three credits. First or second semester.

The Bulletin of the University of Washington
includes the following publications:

ENTRANCE INFORMATION

THE CATALOGUE

BULLETINS OF

COLLEGE OF LIBERAL ARTS

COLLEGE OF SCIENCE

SCHOOL OF EDUCATION

COLLEGE OF ENGINEERING

COLLEGE OF FORESTRY

SCHOOL OF LAW

COLLEGE OF MINES

MUSIC (FINE ARTS)

COLLEGE OF PHARMACY

GRADUATE SCHOOL

EXTENSION DIVISION

SUMMER SESSION

Requests for bulletins, or for general information in regard to the University, and all credentials and correspondence relative to admission or advanced standing should be addressed to **THE RECORDER**, University of Washington, Seattle, Washington.

1914/15

Registration days.....	Monday and Tuesday, February 1-2
Instruction begins.....	Wednesday, February 3
Washington's birthday	Monday, February 22
Spring vacation.....	Friday, April 2, 6 p. m., to Monday, April 12, 8 a. m.
Campus day	Friday, April 30
Junior day	Saturday, May 8
Memorial day (holiday).....	Monday, May 31
Semester examinations, in the Colleges of Liberal Arts, Science, the School of Education, and the Division of Fine Arts, Tuesday, June 1, to Friday, June 11. <i>All other colleges and schools, Monday, June 7, to Friday, June 11.</i>	
Baccalaureate Sunday	June 13
Class day and President's reception.....	Monday, June 14
Alumni day	Tuesday, June 15
Commencement	Wednesday, June 16

THE BOARD OF REGENTS

- *ALEX F. McEWAN, term ending March, 1917.....Seattle
President, August, 1913-December, 1913.
- †HOWARD G. COSGROVE, term ending March, 1915.....Seattle
- *JOHN C. HIGGINS, term ending March, 1914.....Seattle
- ‡CHARLES P. SPOONER, term ending March, 1914.....Seattle
- JOHN A. REA, term ending March, 1916.....Tacoma
- *A. L. ROGERS, term ending March, 1916.....Waterville
- *F. A. HAZELTINE, term ending March, 1917.....South Bend
- *GEORGE H. WALKER, term ending March, 1914.....Seattle
- ELDRIDGE WHEELER, term ending March, 1915.....Montesano
- OSCAR A. FECHTER, term ending March, 1916.....North Yakima
President from January, 1914.
- WINLOCK W. MILLER, term ending March, 1920.....Seattle
- WILLIAM T. PERKINS, term ending March, 1920.....Seattle
- CHARLES E. GACHES, term ending March, 1917.....Mount Vernon
- WILLIAM A. SHANNON, term ending March, 1917.....Seattle
- WILLIAM MARKHAM, Secretary to the Board.
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* Resigned January 1, 1914.

† Resigned December 1, 1913.

‡ Resigned November 1, 1913.

ADMINISTRATIVE OFFICERS

THE UNIVERSITY

- *THOMAS FRANKLIN KANE, PH. D., LL. D., President, Administration Building.
- HENRY LANDES, A. M., Acting President, Administration Building.
- HERBERT THOMAS CONDON, LL. B., Bursar, Administration Building.
- EDWARD NOBLE STONE, A. M., Registrar and Recorder, Administration Building.
- EDWIN BICKNELL STEVENS, A. M., Secretary to the President, Administration Building.
- ISABELLA AUSTIN, A. B., Dean of Women, Denny Hall.

THE COLLEGES AND SCHOOLS

- ARTHUR SEWALL HAGGETT, PH. D., Dean of the College of Liberal Arts, Administration Building and Denny Hall.
- ALMON HOMER FULLER, M. S., C. E., Dean of the College of Engineering, Engineering Building.
- MILNOR ROBERTS, A. B., Dean of the College of Mines, Mines Building.
- CHARLES WILLIS JOHNSON, PH. C., PH. D., Dean of the College of Pharmacy, Bagley Hall.
- JOHN THOMAS CONDON, LL. M., Dean of the School of Law, Law Building.
- HUGO WINKENWERDER, M. F., Dean of the College of Forestry, Good Roads Building.
- J. ALLEN SMITH, PH. D., Dean of the Graduate School, Denny Hall.
- HENRY LANDES, A. M., Dean of the College of Science, Science Hall.
- FREDERICK ELMER BOLTON, PH. D., Dean of the School of Education, Education Building.
- IRVING MACKEY GLEN, A. M., Director of Fine Arts, The Auditorium.

THE EXTENSION DIVISION

- EDWIN AUGUSTUS START, A. M., Director, Administration Building.

THE LIBRARY

- WILLIAM ELMER HENRY, A. M., Librarian, Library Building.

* Leave of absence, January 1 to August 1. Retires August 1, 1914.

COLLEGE OF MINES

FACULTY

*THOMAS FRANKLIN KANE, PH. D., Johns Hopkins, PRESIDENT.

HENRY LANDES, A. M., Harvard, ACTING PRESIDENT.

MILNOR ROBERTS, A. B., Stanford, Professor of Mining Engineering and Metallurgy, DEAN.

HENRY LANDES, A. M., Harvard, Professor of Geology and Mineralogy.

ALMON HOMER FULLER, M. S., C. E., Lafayette, Professor of Civil Engineering.

JOHN THOMAS CONDON, LL. M., Northwestern, Professor of Law.

HORACE BYERS, PH. D., Johns Hopkins, Professor of Chemistry.

TREVOR KINCAID, A. M., Washington, Professor of Zoology.

FREDERICK ARTHUR OSBORN, PH. D., Michigan, Professor of Physics.

ROBERT EDOUARD MORITZ, PH. N. D., Strassburg, Professor of Mathematics and Astronomy.

CARL EDWARD MAGNUSSEN, PH. D., E. E., Wisconsin, Professor of Electrical Engineering.

EVERETT OWEN EASTWOOD, C. E., A. M., Virginia, Professor of Mechanical Engineering.

D. C. HALL, PH. B., M. D., Sc. M., Chicago, Professor of Physical Training.

E. J. McCAUSTLAND, B. C. E., M. C. E., Cornell, Professor of Civil Engineering.

CHARLES CHURCH MORE, M. S., C. E., Lafayette, Associate Professor of Civil Engineering.

HENRY KREITZER BENSON, PH. D., Columbia, Professor of Chemistry.

FRANK MARION MORRISON, PH. D., Chicago, Associate Professor of Mathematics.

LOREN DOUGLAS MILLIMAN, A. B., Michigan, Associate Professor of English.

JOSEPH DANIELS, S. B., M. S., Lehigh, Assistant Professor of Mining Engineering and Metallurgy.

*Leave of absence, January 1 to August 1. Retires August 1, 1914.

VANDERVEER CUSTIS, PH. D., Harvard, Assistant Professor of Economics.

GEORGE SAMUEL WILSON, B. S., Nebraska, Assistant Professor of Mechanical Engineering.

CHARLES M. HARRIS, C. E., Cornell, Assistant Professor of Civil Engineering.

E. A. LOEW, B. S., Wisconsin, Assistant Professor of Electrical Engineering.

CLARENCE RAYMOND COREY, E. M., Montana, Assistant Professor of Mining Engineering and Metallurgy.

HENRY LOUIS BRAKEL, A. M., Washington, Assistant Professor of Physics.

FRANK EDWARD JOHNSON, E. E., Minnesota, Instructor in Electrical Engineering.

GEORGE IRVING GAVETT, B. S., C. E., Assistant Professor in Mathematics.

CHARLES EDWARD WEAVER, PH. D., Assistant Professor in Geology.

JOHN W. MILLER, B. S., Instructor in Civil Engineering.

CHARLES EDWARD NEWTON, E. M., Instructor in Civil Engineering.

SAMUEL THOMAS BEATTIE, Instructor in Woodwork.

J. EDWARD BERG, Assistant in Metallurgy.

L. HAROLD COGSWELL, Assistant in Mining.

EARL T. GODBE, Assistant in Stock Room.

HARVEY L. GLENN, B. S., Lecturer on Assaying of Bullion.

ROBERT F. McELVENNY, E. M., Lecturer on Copper Smelting.

GEORGE BATES HARRINGTON, S. B., Mass. Inst. Tech., Lecturer on the Economics of Mining.

JAMES BAGLEY, State Coal Mine Inspector, Lecturer on Mine Regulations.

ADMISSION TO THE FRESHMAN CLASS

To be admitted to the freshman class, students must either (a) pass an examination based on a four-year course amounting in the aggregate to fifteen units, or (b) complete a course of the same length in an accredited school.

The requirements for admission to the freshman class of the College of Mines for curricula I, II, III and IV, leading to the degrees of bachelor of science in mining engineering, in geology

and mining, in metallurgical engineering or in coal mining engineering are as follows:

	Units
English	3
Algebra	1½
Plane geometry	1
Solid geometry	½
Physics	1
Chemistry	1
One foreign language.....	2
A history, American preferred.....	1
Or United States history, ½; civics, ½.	
Elective	4
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Total	15

For curriculum leading to the degree of bachelor of science (B.S.), (V) the entrance requirements are the same as the above with the exception that chemistry (one unit) is not a fixed requirement; four instead of three units elective are allowed.

DEGREES

The four-year curricula in the College of Mines lead to the following degrees: Curriculum I, bachelor of science in mining engineering; curriculum II, bachelor of science in geology and mining; curriculum III, bachelor of science in metallurgical engineering; curriculum IV, bachelor of science in coal mining engineering.

In addition to the above, curriculum V, which leads to the degree of bachelor of science (B.S.), is offered. The entrance requirements for curriculum V are less technical than for the other curricula and the training given by it is broader. Students who graduate in this curriculum are advised to spend an additional year in study and research according to the schedule given for the degree of master of science in mining engineering (M.S. in Min. E.). A new curriculum in coal mining engineering is offered.

The degree of engineer of mines (E.M.) is given to graduates in mining engineering who have practiced their profession for at least three years, and who present a satisfactory thesis. Graduates in metallurgy may receive the degree of metallurgical engineer (Met. E.) under similar conditions.

MINING AND METALLURGICAL INDUSTRIES AVAILABLE
FOR STUDY

Excellent opportunities for becoming familiar with mining and metallurgical operations are open to students in the College of Mines. The amount of time available during the college year for this purpose is not great and even by using the summer vacations it is impossible for a student to cover the whole field of local industries included in his chosen profession.

Mining machinery of the best type is in operation within easy reach of the University. Much of the heavy mining machinery used in the neighboring states and Alaska is built in the city of Seattle, while patented machines, such as drills and concentrating tables of all makes are kept in stock and as working exhibits by the firms that supply the North Pacific coast regions. The application of hydraulic mining methods to city grading is being carried on locally on a very large scale and with the most approved pumping and piping appliances and methods. Equally important to the mining engineer are the operations of the steam shovels, which are used largely now in iron, copper and gold mining. The engineers in charge of these plants have given the mining students every opportunity to become familiar with the methods of planning and carrying on the work, and the same statement applies to the mine operators throughout the state.

A brief list of the other available works of interest includes coal mines, with the largest production west of the Rocky mountains; metal mines of gold, silver, copper, arsenic, antimony, iron, etc.; cement plants, glass works, several stone quarries and dressing works; clay mines, clay and pottery works; gravel and sand pits with large production and approved methods; a region of varied geology with many economic minerals; the Tacoma and Everett smelters and refineries; the U. S. assay office; the Irondale steel plant of the Western Steel Corporation, and several plants engaged in metallurgical work.

MINING SOCIETY

The Mining Society, affiliated with the American Institute of Mining Engineers, has a membership composed of upperclassmen, graduate students and three sophomores, chosen for the excellence of their records in actual mining. At the monthly meetings of the society addresses are made by prominent mining engineers, and papers descriptive of their summer work are presented by the

student members. The officers for 1913-1914 are, L. H. Cogswell, president; A. H. Swart, vice-president; E. T. Godbe, secretary; A. C. Halferdahl, treasurer.

UNITED STATES MINE RESCUE TRAINING STATION

The United States Mine Rescue Training Station, operated in connection with the College of Mines, occupies a separate building. The "smokeroom" is the largest of its kind in the country, measuring 25 by 50 feet.

Several sets of oxygen apparatus and pulmotor are kept on hand for practice as well as for use in mine rescue work. The purpose of the station is to train miners in the use of oxygen helmets, which are used in cases of mine fires and explosions in both coal and metal mines. From ten days to two weeks' time is required for the course of training. The applicant is taught the construction of the apparatus and is required to wear it for four hours each day, in two periods of two hours each. The practice is carried on in a room filled with gas which cannot be breathed without immediate danger, and the work to be performed is the same as that which would be required in actual mining operations or rescue work. The smokeroom represents a portion of a mine, and is equipped with mine car, track, overcast, timbers and brick. First aid instruction is also given. Applicants who have completed the course of training receive a certificate from the U. S. Bureau of Mines.

INSTRUCTION FOR COAL MINING MEN

Miners taking the rescue training also receive instructions in the College of Mines on the subjects of mine gases, explosions, and the origin and distribution of Pacific Coast and Alaska coals. Laboratory experiments are carried on to show the methods of analyzing coals and determining the uses to which they may be put. The methods of testing for permissible explosives at the Pittsburg Station and the safe methods of charging, tamping and firing are explained.

CURRICULA IN THE COLLEGE OF MINES

FRESHMAN YEAR FOR ALL CURRICULA

FIRST SEMESTER	Hours	SECOND SEMESTER	Hours
Mathematics 1a	4	Mathematics 2a	4
Chemistry 1a	4	Chemistry 2a	4
Civil Engineering 1.....	2	Civil Engineering 3.....	4
English 1a	2	Civil Engineering 20.....	4
Geology 1a	4	Mech. Engineering 9.....	2
Mechanical Engineering 1...	2	Drill	2
Drill	2		
	<hr/> 16+4		<hr/> 16+4

SOPHOMORE YEAR FOR ALL CURRICULA

Mathematics 3a	4	Mathematics 4a	4
Physics 1a	4	Chemistry 9	4
Physics 1b	2	Physics 2a	4
Civil Engineering 28.....	3	Physics 2b	1
Civil Engineering 4.....	2	Geology 9	4
Mining 4	2	Drill	2
Drill	2		
	<hr/> 17+2		<hr/> 17+2

OPTION I IN MINING ENGINEERING

JUNIOR YEAR

FIRST SEMESTER	Hours	SECOND SEMESTER	Hours
*Metallurgy 1	4	*Mining 9	1
*English 2a	2	*Metallurgy 2	4
*Mech. Engineering 3.....	2	*Economics 1a	3
*Mining 21	1	Civil Engineering 50.....	4
Civil Engineering 41.....	4	Geology 17	4
Geology 13	4	Mining practice in summer	
Mining 3	2	vacation.	
	<hr/> 16+3		<hr/> 16

SENIOR YEAR

*Mining 1	4	*Mining 7	1
*Mining 6	1	*Mining 8	2
Metallurgy 5	3	Mining 2	4
Metallurgy 7	3	Mining 22	1
Geology 21	1	Geology 18	4
Electrical Eng. 5.....	4	Metallurgy 13	3
	<hr/> 16		<hr/> 15

*Required in all curricula.

OPTION II IN GEOLOGY AND MINING

JUNIOR YEAR

FIRST SEMESTER	Hours	SECOND SEMESTER	Hours
*Metallurgy 1	4	*Mining 9	1
*English 2a	2	*Metallurgy 2	4
*Mech. Engineering 3.....	2	*Economics 1a	3
*Mining 21	1	Metallurgy 12	3
Metallurgy 3	2	Geology 17	4
Geology 13	4	Geology or mining practice	
Geology 20	1	in summer vacation.	
Civil Engineering 23.....	3		
	<hr/> 16+3		<hr/> 15

SENIOR YEAR

*Mining 1	4	*Mining 7	1
*Mining 6	1	*Mining 8	2
Metallurgy 5	3	Mining 2	4
Metallurgy 7	3	Mining 22	1
Geology 20	1	Geology 18	4
Geology 19	4	Geology 21	1
		Elective	3
	16		16

*Required in all curricula.

OPTION III IN METALLURGICAL ENGINEERING

JUNIOR YEAR

FIRST SEMESTER	Hours	SECOND SEMESTER	Hours
*Metallurgy 1	4	*Mining 9	1
*English 2a	2	*Metallurgy 2	4
*Mech. Engineering 3	2	*Economics 1a	3
*Mining 21	1	Metallurgy 4	3
Metallurgy 10	2	Civil Eng. 50	4
Civil Engineering 41	4	Mech. Eng. 4	2
Elec. Eng. 5	4	Metallurgical practice in summer vacation.	
	16+3		15+2

SENIOR YEAR

*Mining 1	4	*Mining 7	1
*Mining 6	1	*Mining 8	2
Metallurgy 3	2	Mining 2	4
Metallurgy 5	3	Metallurgy 6	3
Metallurgy 7	3	Metallurgy 8	3
Metallurgy 11	1	Geology 18	4
Metallurgy 13	3		
	17		17

*Required in all curricula.

OPTION IV IN COAL MINING ENGINEERING

JUNIOR YEAR

FIRST SEMESTER	Hours	SECOND SEMESTER	Hours
*Metallurgy 1	4	*Mining 9	1
*English 2a	2	*Metallurgy 2	4
*Mech. Engineering 3	2	*Economics 1a	3
*Mining 21	1	Civ. Eng. 50	4
Mining 3	2	Mining 12	2
Civ. Eng. 41	4	Mining 13	2
Geology 16	3	Summer practice in coal mining.	
	15+3		16

SENIOR YEAR

*Mining 1	4	*Mining 7	1
*Mining 6	1	*Mining 8	2
Mining 14	2	Mining 11	2
Mech. Eng. 21 and 40	4	Mining 15	3
Elec. Eng. 5	4	Mining 20	3
Geology 20	1	Mining 16	2
	16	Metallurgy 14	3
			16

*Required in all curricula.

CURRICULUM V IN MINING ENGINEERING

Leading to Degree of Bachelor of Science.

	Hours.
Mathematics 1a, 2a, 3a, 4a.....	16
Chemistry 1, 2, 8b, 9.....	16
English 1a, 2a	4
Modern Foreign Language	12
Physics 1a, 1b, 2a, 2b.....	11
Civil Eng. 1, 3, 4, 20, 28, 41, 42.....	23
Mech. Eng. 1, 3, 9.....	6
Electrical Eng. 5	4
Mining 4, 9, 1, 2, 7.....	12
Metallurgy 1, 2, 8.....	10
Pol. Science 1a	3
Elective	2
Geology 1a, 9, 13, 17, 21.....	17
Drill	8

GRADUATE COURSE IN MINING ENGINEERING

Following Option I and leading to the degree of Master of Science
in Mining Engineering.

Hours	Hours
Mining 10	Mining 22
Mining 6	Mining 7
Metallurgy 7	Mining 8
Mining 3	Metallurgy 4
Metallurgy 13	Geology 18
Elective, engineering.....	Elective, engineering
Mining 21	Mining 11
16+1	16

Equivalent courses in Coal Mining Engineering may be substituted for those listed above.

The degree of Master of Science in Mining Engineering will also be conferred upon graduates of this College or of other mining colleges of the first class who complete a year (32 credit hours) of graduate work, including a satisfactory thesis, with the grade of A or B. The candidate must also pass a formal examination open to all members of the faculty. The selection of work for this degree must in each case be approved by the head of the department in which the student majors.

VI. SHORT SESSION FOR MINING MEN

The eighteenth annual Short Session for mining men will open on January 4th, 1915, continuing until April 10. During this period each year twelve of the instructors in mining engineering offer a course for the benefit of persons who are interested in prospecting, mining, smelting, clay or metal-working. Admission to the classes is without examination. Instruction is given by lectures, laboratory exercises, and visits to mines and plants in

operation. The past experience and future aims of each student are taken into consideration, and the character of his work arranged accordingly.

No preparation is needed for this course. Many practical men with an interest in some branch of mining but without much education have obtained satisfactory results from the course; others with a college education and mining experience have gained much up-to-date training and information. Practically all the students attend the following subjects: Mining, field trips, mineralogy, geology, mining law; in addition to these subjects, fire assaying and general chemistry are studied by many of the quartz miners, while the placer men substitute placer mining and surveying. Assaying is accompanied by chemistry and mineralogy. Students who satisfactorily complete a course of study are given a certificate stating the amount and character of work done. For students who return a second year, a special course is arranged in continuation of their previous work.

The advantages of the University laboratories and libraries are open to all. Students may board and room at the dormitories or elsewhere, as preferred. There are no charges, except for material used. Deposits are made to cover the actual cost of supplies drawn by each student, the balance of the deposit being returned at the end of the course. All deposits are made at the beginning of the course.

SUBJECTS IN THE SHORT SESSION

A. MINING. Lectures on prospecting, development, boring, air-compression, drilling, mining systems, timbering and transportation. Practice in air-compression, machine-drilling and sampling. Study of mine maps, ore deposits and mining districts. Two lectures and one laboratory period a week. M. W. at 9, T. 1 to 5. Professor ROBERTS.

B. MILLING. Lectures and recitations on ore treatment and concentration. Laboratory practice in sampling, testing, and dressing, using breakers, rolls, screens, stamp battery, tables, vanners, jigs, and accessory machinery. Two lectures and one afternoon a week. M. F. at 10, T. 1 to 5. Assistant Professor DANIELS.

C. FIRE ASSAYING. Lectures on sampling, preparing ores for assay, furnaces, fuels, reagents, and the fire assay of gold, silver, lead, and tin ores. The laboratory work includes the testing of

reagents, and the assaying of various ores. One lecture and three afternoons a week in laboratory. Deposit, fifteen dollars. M. W. Th. 1 to 5. Assistant Professor COREY.

D. METALLURGY. A study of the principles of metallurgy for the benefit of those who are engaged in the metal trades or in the mining of ores requiring smelter treatment. Two lectures and one afternoon a week. Deposit, five dollars. Assistant Professor COREY.

E. FIELD TRIPS. An outline study of the operations at neighboring mines, mills, and smelters; geological field studies, followed by laboratory practice on the rocks and minerals found. Saturdays. Professor ROBERTS and Assistant Professor DANIELS.

CHEMISTRY 1d. GENERAL CHEMISTRY AND QUALITATIVE ANALYSIS. Laboratory practice in the determination of the common elements. Three lectures a week, and Saturday laboratory. Deposit, ten dollars. Professor BENSON.

GEOLOGY B. MINERALOGY. Instruction and practice in blowpipe analysis, with lectures upon the common minerals, and practice in the identification of minerals by field tests. Twice a week. Deposit, two dollars. Assistant Professor WEAVER.

GEOLOGY. Lectures on the elements of geology, the common varieties of rock, metalliferous vein and ore deposits, etc. Twice a week. Assistant Professor WEAVER.

MINING LAW. A series of lectures on the mining laws of the United States and Alaska. Illustrated by drawings and mine maps. Once a week. Time to be arranged. Assistant Professor DANIELS and special lecturers.

CIVIL ENG. 19. SURVEYING. Instruction and field practice in the use of simple instruments for making underground and surface surveys; the elements of drawing, lettering, sketch-mapping and field notes; the rules governing mineral surveys. Two lectures and two afternoons a week. Mr. NEWTON.

CIVIL ENG. 54. HYDRAULIC MINING. The elements of hydraulics; the flow of water in pipes, flumes and ditches; the methods and costs of placer mining in its various forms. Two lectures a week. Professor McCAUSTLAND.

MECH. ENG. 3. FORGE. Practice in sharpening and tempering drill steel and picks; systematic training in the making and care

of fires, and the application of various heats, drawing, punching, riveting, bending, twisting, upsetting, welding iron and steel, and making and tempering machine tools. Deposit, two dollars. One afternoon a week. Mr. KANE.

MECH. ENG. 9. MINE TIMBER FRAMING. Shop work in the cutting, framing and erection of various types of timbers employed in mining operations. Deposit, two dollars. One afternoon a week. Mr. BEATTIE.

MINING 21. COAL MINING AND RESCUE TRAINING. For a description of the short courses in coal mining, first aid to the injured and rescue training, see under "Mine Rescue Training Station," page 20. Assistant Professor DANIELS and Government Engineers.

DEPARTMENTS OF INSTRUCTION

MINING ENGINEERING AND METALLURGY

(Mines Building)

PROFESSOR ROBERTS, ASSISTANT PROFESSOR DANIELS, ASSISTANT PROFESSOR COREY; LECTURERS, MR. MCELVENNY, MR. HARRINGTON, MR. GLENN; ASSISTANTS, MR. COGSWELL, MR. BERG, MR. GODBE.

I. MINING ENGINEERING

Coal miners who are taking the ten days course in the U. S. Mine Rescue Training Station are given daily instruction and laboratory demonstrations in the subjects of mine gases, ventilation, the origin and composition of coals, and coal analysis.

1. MINING. Four credits. First semester. Prerequisite, Senior standing. Deposit, \$3.00. M. W. Th. at 10; M. 1 to 4. Professor ROBERTS.

Three lectures and one laboratory period. Lectures on mining, power generation, air compression, hoisting and transportation. Practice with air compressors, machine drills and mine equipment in laboratories and local plants.

2. ORE DRESSING. Four credits. Second semester. Prerequisite, Mining 3. Senior or graduate. Deposit, five dollars. M. Th. at 9; W. Th. 1 to 4. Professor ROBERTS and Assistant Professor DANIELS, and Mr. COGSWELL.

Two lectures and two laboratory periods. A detailed study of certain branches of ore dressing followed by a full test of ores by mill run checked by assays.

3. MILLING. Two credits. First semester. Prerequisite, Junior standing. Deposit, \$3.00. Th. at 9; Th. 2 to 5. Professor ROBERTS and Assistant Professor DANIELS, and Mr. COGSWELL.

One lecture and one laboratory period. Lectures and mill practice in the principles of ore dressing.

4. MINE OPERATION. Two credits. First semester. Prerequisite, Junior standing. M. W. at 9. Assistant Professor DANIELS.

A general study of mine development and operation, considering particularly layout of plant, haulage, hoisting, pumping, etc. The Renton mine is studied in detail.

5. FIELD WORK. One credit. First semester. Time to be arranged. Professor ROBERTS, and Assistant Professor DANIELS.

One laboratory period (or its equivalent in total time required) and monthly seminar. Class or individual visits to a mine, mill, smelter, or engineering work, to be followed by a report with field notes and sketches.

6. THESIS OUTLINE. One credit. First semester. One laboratory period. Time to be arranged. Professor ROBERTS, Assistant Professor DANIELS, and Assistant Professor COREY.

The outlining of senior thesis, the gathering of material, study of references, making of drawings, maps, etc. See mining 8. Senior or graduate.

7. MINE INSPECTION. One credit. Second semester. Time to be arranged. Professor ROBERTS, Assistant Professor DANIELS, and Assistant Professor COREY.

Ten days in the second semester. An excursion by the senior class to a mine or mining district.

8. THESIS. Two credits. Second semester. Two laboratory periods, T. 1 to 4, or S. 8 to 11. Time to be arranged. Professor ROBERTS, Assistant Professor DANIELS, and Assistant Professor COREY.

A continuation of Mining 6. Weekly consultation and seminars.

9. JUNIOR EXCURSION. One credit. Second semester. Required for senior standing. Time to be arranged. Professor ROBERTS, Assistant Professor DANIELS, and Assistant Professor COREY.

An excursion by the junior class to a mine or mining district. Sometimes made in connection with the senior excursion, mining 7.

10. MINING METHODS. Three credits. First semester. Senior or graduate. Time to be arranged. Professor ROBERTS.

Two lectures and one laboratory period. A detailed study of certain branches of mining.

11. MINE MANAGEMENT. Two credits. Second semester. Prerequisite, Senior or graduate standing. Two lectures, M. W. at 11. Assistant Professor DANIELS.

A study of the organization and administration of engineering plants, involving the keeping and interpretation of cost accounts, the efficiency of labor and methods, the financial, legal and social aspects of engineering operation.

12. COAL RESOURCES OF NORTH AMERICA. Two credits. Second semester. Two lectures. Prerequisite, Mining 4. M. W. at 9. Assistant Professor DANIELS.

The occurrence of coal in North America with especial reference to geographic and geologic distribution and structure; study of the various types of coals; classification of coals; commercial requirements of coals.

13. COAL MINING METHODS. Two credits. Second semester. Two lectures. Prerequisite, Mining 4. M. W. at 10. Assistant Professor DANIELS.

Methods of prospecting coal seams; determination of structure and content; methods of development and working, timbering, etc. A detailed study is made of a nearby mine.

14. MINE GASES AND VENTILATION. Two credits. First semester. Two lectures. Prerequisite, Mining 13. M. W. at 8. Assistant Professor DANIELS.

Composition and properties of mine gases, methods of testing. Lighting of mines. Principles of ventilation; ventilating machinery.

15. MINING PLANT. Three credits. First semester. Three drafting periods. Prerequisites, Mining 13, 14. Graduate. Time to be arranged. Assistant Professor DANIELS.

Design of plant and machinery employed in mining and preparing coal for market.

16. COAL MINING MACHINERY. Two credits. Second semester. Two lectures. Prerequisite, Senior standing. Graduate. T. Th. at 10. Assistant Professor DANIELS.

Study of coal cutting machines, mine locomotives, fans, hoists, pumps, and tippie or breaker machinery with special reference to application to coal mining.

20. COAL WASHING. Four credits. Second semester. Two lectures and two laboratory periods. Prerequisite, Mining 3. Graduate. Deposit, \$5.00. T. Th. at 9; W. Th. 1 to 4. Assistant Professor DANIELS.

A detailed study of methods of preparing coal for market, together with laboratory tests and runs on various coal to determine best methods of preparation.

21. MINE RESCUE TRAINING. One credit. First semester. Twenty-five hours' instruction. Th. 10 to 12. Assistant Professor DANIELS.

Practice in the care and use of oxygen rescue apparatus, smoke-room training, and first-aid-to-the-injured work. Required of all students in the junior class.

22. MINING LAW. One credit. Second semester. One lecture. F. at 8. Assistant Professor DANIELS and special lecturers.

A series of lectures on the mining laws of the United States and Alaska, dealing particularly with the subject from the standpoint of the prospector, mining engineer and geologist. Illustrated by diagrams and mine maps.

24. INDUSTRIAL ORGANIZATION. Two credits. Second semester. Time to be arranged. Two lectures. Assistant Professor DANIELS.

A study of the principles of industrial organization and scientific management, involving the consideration of handling labor and materials, methods of operation, cost keeping and performance records, interpretation of efficiency data.

II. METALLURGY

1. FIRE ASSAYING. Four credits. First semester. Prerequisite, Chemistry 9. Deposit, fifteen dollars. T. at 11; F. 1 to 4; S. 8 to 3. Assistant Professor COREY, Mr. GLENN and Mr. BERG.

One lecture and three laboratory periods. The testing of reagents, the crushing, sampling and assaying of ores, furnace and mill products for lead, silver, gold and tin; also, the assay of base and gold bullion.

2. GENERAL METALLURGY. Four credits. Second semester. Deposit, ten dollars. Three lectures and one laboratory period.

T. Th. at 11; T. Th. 1 to 4. Professor ROBERTS, Assistant Professor COREY and Mr. McELVENNY.

The properties of metals and alloys, fuels, refractory materials, furnaces and the extraction of the common metals from their ores. Visits to smelter.

3. METALLURGICAL FUELS. Two credits. First semester. Deposit, five dollars. W. at 11; T. 8 to 11. Assistant Professor DANIELS.

One lecture and one laboratory period. The composition, manufacture and metallurgical uses of natural and prepared fuels; the methods and costs of coking, gas making, and coal briquetting. Furnace and calorimeter tests of various types of fuels.

4. COPPER AND LEAD. Three credits. Second semester. M. W. F. at 10. Assistant Professor COREY.

Three lectures. The metallurgy of copper and lead, especially the methods of roasting, smelting and refining.

5. GOLD AND SILVER. Three credits. First semester. Deposit, \$5.00. Two lectures and one laboratory period. M. W. at 9; W. 1 to 4. Assistant Professor COREY.

Amalgamation, cyaniding, and chlorination of gold and silver ores. Complete tests checked by assays.

6. MINOR METALS. Three credits. Second semester. Two lectures and one laboratory period. Deposit, five dollars. M. W. at 8; M. 1 to 4. Assistant Professor COREY.

The metallurgy of zinc, antimony, tin, aluminum, nickel, etc.; a study of the plant required, the methods and costs of treatment.

7. WET ASSAYING. Three credits. First semester. One lecture. Two laboratory periods. Prerequisite, Chemistry 9. Deposit, ten dollars. W. at 8; Th. 1 to 4; F. 8 to 11. Assistant Professor COREY.

Technical methods for the determination of copper, lead, zinc, etc., in ores and furnace products, etc.

8. METALLURGICAL ANALYSIS. Three credits. Second semester. One lecture. Two laboratory periods. Prerequisite, Chemistry 9. Deposit, ten dollars. W. at 9; T. 8 to 11; F. 1 to 4. Assistant Professor COREY.

Technical methods of analysis of slags and industrial products.

9. PYROMETRY AND ALLOYS. Two credits. Second semester. One lecture and one laboratory period. Deposit, three dollars. Time to be arranged. Assistant Professor COREY.

Methods of measuring high temperatures. Union of metals by fusion, compression and electro-deposition; the behavior of metals and alloys under heat. Laboratory practice in thermal measurements, synthesis and testing of alloys.

10. METALLOGRAPHY. Two credits. First semester. One lecture and laboratory period. Deposit, three dollars. Th. at 8; W. 1 to 4. Assistant Professor DANIELS.

The constitution and microstructure of metals and alloys, especially iron and steel. The preparation and study of metal sections, photomicrography and the use of the microscope to aid in testing structural iron and steel.

11. METALLURGICAL PROBLEMS. One credit. First semester. Prerequisites, Chemistry 9, and Metallurgy 2. M. at 11. Assistant Professor COREY.

Physical chemistry for the metallurgist, slag calculations, etc., illustrated by figures quoted from the present practice at a number of smelting plants.

12. REFRACTORIES. Three credits. Second semester. One lecture and two laboratory periods. Deposit, three dollars. M. at 9; Th. S. 8 to 11. Assistant Professor COREY.

Methods of testing clays, refractory materials, cement-making materials.

13. DESIGN OF PLANT. Three credits. Either semester. Three drafting periods. Senior or graduate. 1st sem., T. F. 1 to 5; 2nd sem., M. F. 1 to 5. Professor ROBERTS and Assistant Professor DANIELS.

The designing of a piece of equipment or a structure for mining, milling or metallurgical purposes.

14. IRON AND STEEL. Three credits. Second semester. Three lectures. M. W. Th. at 8. Assistant Professor DANIELS.

The metallurgy and manufacture of commercial iron and steel, with special reference to their properties and uses in engineering work.

THESIS. See Mining 6 and 8.

SUMMER FIELD WORK. See Mining 7 and 8.

SUBJECTS PRESENTED BY DEPARTMENTS IN OTHER
COLLEGES OF THE UNIVERSITY
CHEMISTRY

(Bagley Hall)

1, 2. GENERAL CHEMISTRY. Four credits. The year. Text-books, Smith's College Chemistry and Laboratory Manual. T. Th. at 11; M. W. 8 to 11. Professor BYERS, Instructors and Assistants.

1a, 2a. GENERAL CHEMISTRY. Four credits. The year. Consists of two lectures and six laboratory hours per week. Text-books, Smith's General Chemistry, Smith's Laboratory Manual, and Byers and Knight's Qualitative Analysis. Prerequisite, one year high school chemistry. M. W. at 11, M. W. 8 to 11. Professor BYERS, Dr. TRUMBULL and Assistants.

1b. GENERAL CHEMISTRY. Four credits. Second semester. Repetition of 1a. T. Th. at 8. Lab. T. Th. 9 to 12 or M. F. 1 to 4. Assistant Professor ROSE.

Strong students or those carrying light course will be permitted to elect this course without the prerequisite high school course; but to satisfy the required work of the engineering curricula, such students must elect some other four-hour course in the department of chemistry.

2b. GENERAL CHEMISTRY. Four credits. First semester. Continuation of 1b. T. Th. at 8, T. Th. 9 to 12. Assistant Professor ROSE.

1d. PROSPECTOR'S COURSE. Four credits. Deposit, ten dollars. T. Th. F. at 9, F. 1 to 4. Professor BENSON.

For miners who may enter January 1, and will continue to April 1. Does not require previous knowledge of chemistry, and will be merged into a course of qualitative analysis. The text is Brownlee.

9-9. QUANTITATIVE ANALYSIS. Four credits. Either semester. Gravimetric and volumetric analysis. Olson's Quantitative Analysis. Twelve laboratory hours and one recitation per week. Th. at 8, T. F. 1 to 4, T. 8 to 11. Dr. BELL.

CIVIL ENGINEERING

(Engineering Building)

1. ENGINEERING DRAWING. Two credits. The year. All freshman engineers. Prerequisites, plane geometry. First semester, T. Th. 8 to 11. Second semester, T. W. or M. W. 2 to 5. Assistant Professor HARRIS, Mr. GLEASON, Mr. MAY, Mr. STRANDBERG, Mr. WARNER.

Linear drawing, Roman and Gothic capital letters; free hand lettering.

3. ENGINEERING DRAWING. Four credits. The year. All freshman engineers. Prerequisites, solid geometry, preceded or accompanied by drawing 1. First semester, T. Th. at 1, T. Th. 2 to 5. Second semester, T. Th. at 1, F. S. 8 to 11. Assistant Professor HARRIS, Mr. STRANDBERG, Mr. WARNER.

The elements of descriptive geometry, including the principles of shades, shadows and perspective.

4. ENGINEERING DRAWING. Two credits. First semester. All freshman engineers. Prerequisite, 3. T. Th. 1 to 4. Mr. WARNER. Continuation of drawing 3. Problems and tracing.

20. ELEMENTARY PLANE SURVEYING. Four credits. The year. All freshman engineers. Prerequisites, Math. 1a and C. E. 1. Laboratory deposit, three dollars. First semester, M. W. at 8, W. F. 1 to 4. Second semester, M. W. at 1, T. Th. 8 to 11. Mr. GLEASON, Mr. BURRITT and assistants.

Theory and use of chain, compass, transit and level. Adjustment of instruments. United States Public Land surveys. Maps and computation of areas.

23. TOPOGRAPHIC SURVEYING. Three credits. The year. Junior Min. E. Prerequisites, Math. 3a and C. E. 21. Laboratory deposit, three dollars. M. W. at 10, Th. 1 to 5. Mr. MILLER.

Base line measurement. Reading and adjusting and computing triangulation systems. Topographic surveying, including plane-table, photography and cartography.

28-28. MINE SURVEYING. Three credits. Either semester. Sophomore mining engineers. Prerequisite, C. E. 20. Laboratory deposit, three dollars. T. at 11, W. 1 to 5. Mr. NEWTON.

Surface and underground practice. Observation for meridian. Topography. Mining claim surveys. Plane triangulation. Tunnel and vertical shaft work and connections. Mapping.

41-42. MECHANICS. 41, four credits, the year. 1st sem., M. W. F. 1 to 4 or 9 to 12; 2nd sem., M. W. F. 9 to 12. 42, three credits, the year. 1st sem., T. Th. 8 to 11; 2nd sem., M. W. 2 to 5 or T. Th. 1 to 4. All junior engineers. Prerequisites, Math. 4a, physics 1a. Professor MORE, Assistant Professor MACINTIRE and Mr. MAY. Statics, dynamics and mechanics of materials.

(NOTE: Students entering this course must give satisfactory evidence of a *working knowledge* of the fundamentals of arithmetic, algebra, geometry and trigonometry.)

50. HYDRAULICS. Four credits. Second semester. All junior engineers. Prerequisite, preceded or accompanied by 42. M. W. F. at 9, Th. 1 to 4; M. W. F. at 11, F. 1 to 4; M. W. F. at 11, T. 8 to 11. Assistant Professor HARRIS and Mr. STRANDBERG.

Flow of water through pipes and orifices, over weirs and in open channels; energy, impulse and reaction of jets with application to impulse wheels. Review of hydrostatics.

54. HYDRAULIC MINING. (Short session in mining, January-March). Professor McCAUSTLAND.

A course of two lectures per week on the theory and practice of hydraulic mining.

ELECTRICAL ENGINEERING

(Engineering Building)

5. ELECTRICAL ENGINEERING. Four credits. The year. Prerequisites: Math 4a; Physics 2a, 2b. First sem., T. Th. at 8, F. 8 to 12; T. Th. at 9, T. 1 to 5. Mr. CURTIS and Mr. JOHNSON. Second sem., T. Th. at 11, Th. 1 to 5. Assistant Professor LOEW and Mr. CURTIS.

A short course giving the fundamental principles of direct currents with experimental tests on commercial dynamos and motors.

ENGLISH

(Office, Room 45, Denny Hall)

1a-1a. FRESHMAN COMPOSITION. Two credits. First semester. An adaptation of 1 for students of engineering. 1st sem., M. W. at 3; 2nd sem., T. Th. at 1. Associate Professor MILLIMAN in charge.

2a. FRESHMAN COMPOSITION. Two credits. First and second semesters. For students of engineering entering at mid-year. F. S. at 10. Associate Professor MILLIMAN in charge.

GEOLOGY

(Science Hall)

1a. GEOLOGY FOR ENGINEERING AND MINING STUDENTS. Four credits. First semester. Required course for sophomores. Laboratory deposit, \$1.00. T. Th. S. at 9. Laboratory F. 2 to 5. Assistant Professor BRETZ.

1b. GEOLOGY FOR ENGINEERING AND MINING STUDENTS. Elective for freshmen. Four credits. First semester. Laboratory deposit, \$1.00. M. W. F. at 1. Laboratory M. 2 to 5. Assistant Professor BRETZ.

1c. GEOLOGY FOR ENGINEERING AND MINING STUDENTS. Four credits. Second semester. T. Th. S. at 9. Laboratory Th. 2 to 5. Laboratory deposit, \$1.00. Repetition of 1a. Assistant Professor BRETZ.

9. MINERALOGY. Four credits. Second semester. Two laboratory periods. Descriptive and determinative mineralogy. Laboratory deposit, \$2.00. T. Th. at 11. Laboratory, M. W. 2 to 5. Assistant Professor BRETZ.

13. OPTICAL CRYSTALLOGRAPHY. Four credits. First semester. Two recitations and two laboratory periods per week. Laboratory deposit, \$2.00. M. W. at 8. Laboratory, M. W. 1 to 4. Assistant Professor WEAVER.

16. PETROLOGY. Three credits. First semester. One recitation and two laboratory periods. Laboratory deposit, \$2.00. For coal mining engineers. T. Th. at 1. Laboratory, W. 1 to 4. Assistant Professor WEAVER.

A study of the principal types of rocks and practice in their determination by field methods.

17. PETROGRAPHY. Four credits. Second semester. Prerequisites, 1a, 9, 13. Laboratory deposit, \$2.00. M. W. at 11. Laboratory, M. W. 1 to 4. Assistant Professor WEAVER.

A study of the distinguishing characteristics of the different groups and species of rocks with practice in their determination by modern petrographical methods.

18. ECONOMIC GEOLOGY. Four credits. Second semester. Four recitations per week. M. W. F. S. at 10. Professor LANDES.

19. PALEONTOLOGY. Four credits. First semester. Three recitations and one laboratory period per week. Chiefly for students in geology and mining. M. W. F. at 11. Laboratory, F. 1 to 4. Assistant Professor WEAVER.

20. FIELD WORK. One credit. First semester. Hours to be arranged.

21. FIELD WORK. One credit. Second semester. Hours to be arranged. Professor LANDES, Assistant Professors SAUNDERS and WEAVER.

B. PROSPECTOR'S GEOLOGY AND MINERALOGY. Lectures, recitations, and laboratory work in general geology and mineralogy. This course is given in January, February, and March, to the students in the short course for mining men. Laboratory deposit, \$2.00. Assistant Professor WEAVER.

MATHEMATICS

(Science Hall)

O-O. SOLID GEOMETRY. Two credits. The year. Prerequisite, Plane Geometry. T. Th. or M. W. at 4.

Required during the freshman year of all students in the colleges of Engineering, Forestry and Mines who do not offer solid geometry for admission.

1a. TRIGONOMETRY AND ALGEBRA. Four credits. First or second semester. Prerequisites, same as for Math. 1-2. 1st sem., T. W. Th. F. at 2; 2nd sem., M. W. F. S. at 8, or M. T. Th. F. at 2.

Primarily for students in the colleges of Engineering, Forestry, and Mines. The elements of plane trigonometry and supplementary work in algebra equivalent to one hour per week.

2a. ANALYTICAL GEOMETRY AND ALGEBRA. Four credits. First or second semester. Prerequisite, Math 1a. 1st sem., M. W. F. S. at 9; 2nd sem., M. T. W. Th. at 2.

Primarily for students in the colleges of Engineering, Forestry, and Mines. The elements of analytical geometry and supplementary work in algebra equivalent to one hour per week.

3a. CALCULUS FOR ENGINEERS. Four credits. First or second semester. 1st sem., M. W. F. S. at 10 or 9; 2nd sem., M. W. F. S. at 8 or 9.

4a. CALCULUS FOR ENGINEERS. Four credits. First or second semester. 1st sem., M. W. F. S. at 8; 2nd sem., M. W. F. S. at 10 or 9.

Continuation of Math. 3a.

5a. APPLICATION OF THE CALCULUS FOR ENGINEERS. Two credits. First or second semester. Prerequisite, Math. 4a. 1st sem., T. Th. at 8 or 10; 2nd sem., T. Th. at 8.

MECHANICAL ENGINEERING

(Office, Engineering Building)

1. CARPENTRY AND WOODTURNING. Two credits. The year. 1st sem., S. 8 to 12; 2nd sem., T. Th. 10 to 12, F. 1 to 5. Mr. BEATTIE.

3. FORGE AND FOUNDRY. Two credits. The year. 1st sem., F. 1 to 5; Th. 1 to 5; 2nd sem., Th. 1 to 5, W. 1 to 5. Mr. KANE.

4. MACHINE WORK. Two credits. The year. 1st sem., M. 1 to 5; 2nd sem., M. 1 to 5, T. 1 to 5. Mr. KANE.

9. MINE TIMBER FRAMING. Two credits. Second semester. W. at 4, W. 1 to 4. Mr. BEATTIE, Assistant Professor DANIELS.

MILITARY SCIENCE AND TACTICS

(Office, The Armory)

EDWARD E. MCCAMMON, FIRST LIEUTENANT THIRD INFANTRY, U. S. A.,
COMMANDANT

A course of two years in military training is required. All able-bodied male students (except those from foreign countries, not intending to become naturalized) must take the course, which by regulation of the University is required during the first and second years. Three hours a week are devoted to military training, for which two credits are given each semester. M. W. F. at 11, or T. Th. F. at 11.

PHYSICS

(Basement, Denny Hall)

1a. MECHANICS AND WAVE MOTION. Four credits. First or second semester. Prerequisite, 8 hours in mathematics. This course must be accompanied by 1b. 1st sem., M. W. F. S. at 8; 2nd sem. at 10. Dr. ANDERSON.

2a. LIGHT, HEAT, ELECTRICITY. Four credits. First or second semester. This course must be accompanied by 2b. 1st sem., M. W. F. S. at 10; 2nd sem. at 8. Professor BRAKEL.

1b. PHYSICS MEASUREMENTS. Two credits. First or second semester. One four-hour laboratory period. Six dollars deposit per year. 1st sem., T. or Th. or F. 1 to 5; 2nd sem., F. 1 to 5. Mr. VORIS.

2b. PHYSICS MEASUREMENTS. One credit. First or second semester. One three-hour laboratory period. 1st sem., W. 2 to 5; 2nd sem., W. or Th. 1 to 4. Mr. VORIS.

POLITICAL AND SOCIAL SCIENCE

(Denny Hall)

1a. ELEMENTS OF ECONOMICS. Three credits. First or second semester. M. W. F. at 8, 9, 10, 11, 1, or 2.

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BULLETIN

University of Washington

SERIES I

APRIL, 1915

NO. 90—PART 9

College of Mines

1915—1916



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SEATTLE, WASHINGTON

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1915

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UNIVERSITY CALENDAR

1915-1916

Summer sessionJune 21 to July 31

FIRST SEMESTER

Examinations for admission and for exemption from

College English

.....Thursday, Friday and Saturday, September 9, 10, 11

Registration days....Monday and Tuesday, September 13 and 14

Instruction begins.....Wednesday, September 15

President's annual address.....Friday, September 17, 10 a. m.

Women's assembly.....Friday, September 24, 11 a. m.

Assembly of the Associated Students.....

.....Wednesday, September 29, 9 a. m.

Thanksgiving vacation.... } Wednesday, November 24, 6 p. m.
to Monday, November 29, 8 a. m.

Assembly of the Associated Students.....

.....Wednesday, December 8, 1 p. m.

Christmas vacation..... } Friday, December 17, 6 p. m.
to Monday, January 3, 8 a. m.

Semester examinations } Monday, Tuesday, Wednesday, Thurs-
day, Friday, January 24, 25, 26, 27, 28

SECOND SEMESTER

Registration days

.....Monday and Tuesday, January 31 and February 1

Instruction begins.....Wednesday, February 2

Women's assembly.....Friday, February 4, 11 a. m.

Washington's birthday (holiday).....Tuesday, February 22

Spring vacation..... } Friday, March 31, 6 p. m.
to Monday, April 10, 8 a. m.

Assembly of the Associated Students..Thursday, April 13, 9 a. m.

Campus day.....Friday, April 28

Junior day.....Saturday, May 6

Memorial day (holiday)Tuesday, May 30

Semester examinationsJune 5, 6, 7, 8, 9, 10

Baccalaureate SundayJune 11

Class day and President's reception.....Monday, June 12

Alumni dayTuesday, June 13

Commencement.....Wednesday, June 14

THE BOARD OF REGENTS

OSCAR A. FECHTER, President.....	North Yakima
Term ends March, 1916.	
ELDRIDGE WHEELER	Montesano
Term ends March, 1915.	
JOHN A. REA	Tacoma
Term ends March, 1916.	
CHARLES E. GACHES.....	Mount Vernon
Term ends March, 1917.	
WILLIAM A. SHANNON	Seattle
Term ends March, 1917.	
WINLOCK W. MILLER	Seattle
Term ends March, 1920.	
WILLIAM T. PERKINS	Seattle
Term ends March, 1920.	
WILLIAM MARKHAM, Secretary to the Board.	

ADMINISTRATIVE OFFICERS

THE UNIVERSITY

HENRY LANDES, A. M., Acting President, Administration Building.
HERBERT THOMAS CONDON, LL. B., Bursar, Administration Building.
EDWARD NOBLE STONE, A. M., Registrar and Recorder, Administration Building.
EDWIN BICKNELL STEVENS, A. M., Secretary to the President, Administration Building.
ISABELLA AUSTIN, A. B., Dean of Women, Denny Hall.

THE COLLEGES AND SCHOOLS

ARTHUR SEWALL HAGGETT, PH. D., Dean of the College of Liberal Arts, Administration Building and Denny Hall.
ALMON HOMER FULLER, M. S., C. E., Dean of the College of Engineering, Engineering Building.
MILNOR ROBERTS, A. B., Dean of the College of Mines, Mines Building.
CHARLES WILLIS JOHNSON, PH. C., PH. D., Dean of the College of Pharmacy, Bagley Hall.
JOHN THOMAS CONDON, LL. M., Dean of the School of Law, Law Building.
HUGO WINKENWERDER, M. F., Dean of the College of Forestry, Good Roads Building.
J. ALLEN SMITH, PH. D., Dean of the Graduate School, Denny Hall.
THEODORE CHRISTIAN FRYE, PH. D., Acting Dean of the College of Science, Science Hall.
FREDERICK ELMER BOLTON, PH. D., Dean of the College of Education, Education Building.
IRVING MACKEY GLEN, A. M., Dean of the College of Fine Arts, Meany Hall.

THE EXTENSION DIVISION

EDWIN AUGUSTUS START, A. M., Director, Administration Building.

THE LIBRARY

WILLIAM ELMER HENRY, A. M., Librarian, Library Building.

COLLEGE OF MINES

FACULTY

HENRY LANDES, A. M. (Harvard), ACTING PRESIDENT.

MILNOR ROBERTS, A. B. (Stanford), Professor of Mining Engineering and Metallurgy, DEAN.

ALMON HOMER FULLER, M. S., C. E. (Lafayette), Professor of Civil Engineering.

JOHN THOMAS CONDON, LL. M. (Northwestern), Professor of Law.

HORACE BYERS, PH. D. (Johns Hopkins), Professor of Chemistry.

TREVOR KINCAID, A. M. (Washington), Professor of Zoology.

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ROBERT EDOUARD MORITZ, PH. D. (Strassburg), Professor of Mathematics and Astronomy.

CARL EDWARD MAGNUSSON, PH. D, E. E. (Wisconsin), Professor of Electrical Engineering.

EVERETT OWEN EASTWOOD, C. E., A. M. (Virginia), Professor of Mechanical Engineering.

DAVID CONNOLLY HALL, Sc. M., M. D. (Chicago), Professor of Physical Training.

WILLIAM FRANKLIN ALLISON, C. E. (Cornell), Professor of Highway and Municipal Engineering.

CHARLES CHURCH MORE, M. S., C. E. (Lafayette), Associate Professor of Civil Engineering.

HENRY KREITZER BENSON, PH. D. (Columbia), Professor of Chemistry.

FRANK MARION MORRISON, PH. D. (Chicago), Associate Professor of Mathematics.

LOREN DOUGLAS MILLIMAN, A. B. (Michigan), Associate Professor of English.

JOSEPH DANIELS, S. B., M. S. (Lehigh), Assistant Professor of Mining Engineering and Metallurgy.

VANDERVEER CUSTIS, PH. D. (Harvard), Assistant Professor of Economics.

GEORGE SAMUEL WILSON, B. S. (Nebraska), Assistant Professor of Mechanical Engineering.

CHARLES M. HARRIS, C. E. (Cornell), Assistant Professor of Civil Engineering.

EDGAR ALLEN LOEW, B. S. (Wisconsin), Assistant Professor of Electrical Engineering.

*CLARENCE RAYMOND COREY, E. M. (Montana), Assistant Professor of Mining Engineering and Metallurgy.

HENRY LOUIS BRAKEL, A. M. (Washington), Assistant Professor of Physics.

JOHN W. MILLER, B. S. (Nebraska), Assistant Professor of Civil Engineering.

GEORGE IRVING GAVETT, B. S., C. E. (Michigan), Assistant Professor of Mathematics.

CHARLES EDWARD WEAVER, PH. D. (California), Assistant Professor of Geology.

FRANK EDWARD JOHNSON, E. E. (Minnesota), Instructor in Electrical Engineering.

DONALD G. CAMPBELL, E. M., M. A. (Columbia), Instructor in Metallurgy.

CHARLES EDWARD NEWTON, E. M. (Michigan), Instructor in Civil Engineering.

SAMUEL THOMAS BEATTIE, Instructor in Woodwork.

RUDOLF RIEDER, A. B. (Wisconsin), Instructor in German.

E. ROSCOE WILCOX, Assistant in Metallurgy.

VILLEROY GLEASON, JR., Assistant in Mining.

EDWARD L. SWEENEY, Assistant in Stock Room.

HARVEY L. GLENN, B. S., Lecturer on Assaying of Bullion.

ROBERT F. McELVENNY, E. M., Lecturer on Copper Smelting.

FREDERICK POWELL, A. B., Lecturer on Gold Dredging.

* Absent on leave, 1914-15.

ADMISSION TO THE FRESHMAN CLASS

To be admitted to the freshman class, students must either (a) pass an examination based on a four-year course amounting in the aggregate to fifteen units, or (b) complete a course of the same length in an accredited school.

The requirements for admission to the freshman class of the College of Mines for curricula I, II, III and IV, leading to the degrees of bachelor of science in mining engineering, in geology and mining, in metallurgical engineering or in coal mining engineering are as follows:

	Units
English	3
Algebra	1½
Plane geometry	1
Solid geometry	½
Physics	1
Chemistry	1
One foreign language.....	2
A history, American preferred.....	1
Or United States history, ½; civics, ½	
Elective	4
Total.....	15

For the curriculum leading to the degree of bachelor of science (B.S.), (V) the entrance requirements are the same as the above with the exception that chemistry (one unit) is not a fixed requirement; four instead of three units elective are allowed.

DEGREES

The four-year curricula in the College of Mines lead to the following degrees: Curriculum I, bachelor of science in mining engineering; curriculum II, bachelor of science in geology and mining; curriculum III, bachelor of science in metallurgical engineering; curriculum IV, bachelor of science in coal mining engineering.

In addition to the above, curriculum V, which leads to the degree of bachelor of science (B.S.), is offered. The entrance requirements for curriculum V are less technical than for the other curricula and the training given by it is broader. Students who

graduate in this curriculum are advised to spend an additional year in study and research according to the schedule given for the degree of master of science in mining engineering (M. S. in Min. E.). A new curriculum in coal mining engineering is offered.

The degree of engineer of mines (E. M.) is given to graduates in mining engineering who have practiced their profession for at least three years, and who present a satisfactory thesis. Graduates in metallurgy may receive the degree of metallurgical engineer (Met. E.) under similar conditions.

MINING AND METALLURGICAL INDUSTRIES AVAILABLE FOR STUDY

Excellent opportunities for becoming familiar with mining and metallurgical operations are open to students in the College of Mines. The amount of time available during the college year for this purpose is not great and even by using the summer vacations it is impossible for a student to cover the whole field of local industries included in his chosen profession.

Mining machinery of the best type is in operation within easy reach of the University. Much of the heavy mining machinery used in the neighboring states and Alaska is built in the city of Seattle, while patented machines, such as drills and concentrating tables of all makes, are kept in stock and as working exhibits by the firms that supply the North Pacific coast regions. The application of hydraulic mining methods to city grading is being carried on locally on a very large scale and with the most approved pumping and piping appliances and methods. Equally important to the mining engineer are the operations of the steam shovels, which are used largely now in iron, copper and gold mining. The engineers in charge of these plants have given the mining students every opportunity to become familiar with the methods of planning and carrying on the work, and the same statement applies to the mine operators throughout the state.

A brief list of the other available works of interest includes coal mines, with the largest production west of the Rocky mountains; metal mines of gold, silver, copper, arsenic, antimony, iron, etc.; cement plants, glass works, several stone quarries and dressing works; clay mines, clay and pottery works; gravel and sand pits with large production and approved methods; a region of varied geology with many economic minerals; the Tacoma and

Everett smelters and refineries; the U. S. assay office; the West Seattle steel plant of the Western Steel Corporation, and several plants engaged in metallurgical work.

MINING SOCIETY

The Mining Society, affiliated with the American Institute of Mining Engineers, has a membership composed of upperclassmen, graduate students and three sophomores, chosen for the excellence of their records in actual mining. At the monthly meetings of the society addresses are made by prominent mining engineers, and papers descriptive of their summer work are presented by the student members. The officers for 1914-1915 are Villeroy Gleason, Jr., president; E. C. Will, vice-president; L. G. Gerhart, secretary and treasurer; Conrad Hoff, corresponding secretary.

UNITED STATES MINE RESCUE TRAINING STATION.

The United States Mine Rescue Training Station, operated in connection with the College of Mines, occupies a separate building. The "smokeroom" is the largest of its kind in the country, measuring 25 by 50 feet.

Several sets of various types of oxygen rescue and resuscitation apparatus are kept on hand for practice as well as for use in mine rescue work. The purpose of the station is to train miners in the use of oxygen helmets, which are used in cases of mine fires and explosions in both coal and metal mines. From ten days to two week's time is required for the course of training. The applicant is taught the construction of the apparatus and is required to wear it for four hours each day, in two periods of two hours each. The practice is carried on in a room filled with gas which cannot be breathed without immediate danger, and the work to be performed is the same as that which would be required in actual mining operations or rescue work. The smoke-room represents a portion of a mine, and is equipped with mine car, track, overcast, timbers and brick. First aid instruction is also given. Applicants who have completed the course of training receive a certificate from the U. S. Bureau of Mines.

INSTRUCTION FOR COAL MINING MEN

Miners taking the rescue training also receive instructions in the College of Mines on the subjects of mine gases, explosions, and the origin and distribution of Pacific Coast and Alaska coals.

Laboratory experiments are carried on to show the methods of analyzing coals and determining the uses to which they may be put. The methods of testing for permissible explosives at the Pittsburg Station and the safe methods of charging, tamping and firing are explained.

CURRICULA IN THE COLLEGE OF MINES

FRESHMAN YEAR FOR ALL CURRICULA

FIRST SEMESTER	Hours	SECOND SEMESTER	Hours
Mathematics 1a.....	4	Mathematics 2a.....	4
Chemistry 1a.....	4	Chemistry 2a.....	4
Civil Engineering 1.....	2	Civil Engineering 3.....	4
English 1a.....	2	Civil Engineering 20.....	4
Geology 1b.....	4	Mech. Engineering 9.....	2
Mechanical engineering 1...	2	Drill	2
Drill	2		
	<hr/> 16+4		<hr/> 16+4

SOPHOMORE YEAR FOR ALL CURRICULA

Mathematics 3a.....	4	Mathematics 4a.....	4
Physics 1a.....	4	Chemistry 9.....	4
Physics 1b.....	2	Physics 2a.....	4
Civil Engineering 28.....	3	Physics 2b.....	1
Civil Engineering 4.....	2	Geology 9.....	4
Mining 4.....	2	Drill	2
Drill	2		
	<hr/> 17+2		<hr/> 17+2

OPTION I IN MINING ENGINEERING

JUNIOR YEAR

FIRST SEMESTER	Hours	SECOND SEMESTER	Hours
*Metallurgy 1.....	4	*Mining 9.....	1
*English 2a.....	2	*Metallurgy 2.....	4
*Mech. Engineering 3.....	2	*Economics 1a.....	3
*Mining 21.....	1	Civil Engineering 50.....	4
Civil Engineering 41.....	4	Geology 17.....	4
Geology 13.....	4	Mining practice in summer vacation.	
Mining 3.....	2		
	<hr/> 16+3		<hr/> 16

SENIOR YEAR

*Mining 1.....	4	*Mining 7.....	1
*Mining 6.....	1	*Mining 8.....	2
Metallurgy 5.....	3	Mining 2.....	4
Metallurgy 7.....	3	Mining 22.....	1
Geology 21.....	1	Geology 18.....	4
Electrical Eng. 5.....	4	Metallurgy 13.....	3
	<hr/> 16		<hr/> 15

* Required in all curricula.

OPTION II IN GEOLOGY AND MINING

JUNIOR YEAR

FIRST SEMESTER	Hours	SECOND SEMESTER	Hours
*Metallurgy 1.....	4	*Mining 9.....	1
*English 2a.....	2	*Metallurgy 2.....	4
*Mech. Engineering 3.....	2	*Economics 1a.....	3
*Mining 21.....	1	Metallurgy 12.....	3
Metallurgy 3.....	2	Geology 17.....	4
Geology 13.....	4	Geology or mining practice	
Geology 20.....	1	in summer vacation.	
Civil Engineering 23.....	3		
	<hr/> 16+3		<hr/> 15

SENIOR YEAR

*Mining 1.....	4	*Mining 7.....	1
*Mining 6.....	1	*Mining 8.....	2
Metallurgy 5.....	3	Mining 2.....	4
Metallurgy 7.....	3	Mining 22.....	1
Geology 21.....	1	Geology 18.....	4
Geology 19.....	4	Geology 22.....	1
		Elective	3
	<hr/> 16		<hr/> 16

OPTION III IN METALLURGICAL ENGINEERING

JUNIOR YEAR

FIRST SEMESTER	Hours	SECOND SEMESTER	Hours
*Metallurgy 1.....	4	*Mining 9.....	1
*English 2a.....	2	*Metallurgy 2.....	4
*Mech. Engineering 3.....	2	*Economics 1a.....	3
*Mining 21.....	1	Metallurgy 4.....	3
Metallurgy 10.....	2	Civil Eng. 50.....	4
Civil Engineering 41.....	4	Mech. Eng. 4.....	2
Elec. Eng. 5.....	4	Metallurgical practice in sum-	
		mer vacation.	
	<hr/> 16+3		<hr/> 15+2

SENIOR YEAR

*Mining 1.....	4	*Mining 7.....	1
*Mining 6.....	1	*Mining 8.....	2
Metallurgy 3.....	2	Mining 2.....	4
Metallurgy 5.....	3	Metallurgy 6.....	3
Metallurgy 7.....	3	Metallurgy 8.....	3
Metallurgy 11.....	1	Geology 18.....	4
Metallurgy 13.....	3		
	<hr/> 17		<hr/> 17

* Required in all curricula.

OPTION IV IN COAL MINING ENGINEERING

JUNIOR YEAR

FIRST SEMESTER	Hours	SECOND SEMESTER	Hours
*Metallurgy 1.....	4	*Mining 9.....	1
*English 2a.....	2	*Metallurgy 2.....	4
*Mech. Engineering 3.....	2	*Economics 1a.....	3
*Mining 21.....	1	Civ. Eng. 50.....	4
Mining 3.....	2	Mining 12.....	2
Civ. Eng. 41.....	4	Mining 13.....	2
Geology 16.....	3	Summer practice in coal min- ing.	
	<hr/> 15+3		<hr/> 16

SENIOR YEAR

*Mining 1.....	4	*Mining 7.....	1
*Mining 6.....	1	*Mining 8.....	2
Mining 14.....	2	Mining 11.....	2
Mech. Eng. 21 and 40.....	4	Mining 15.....	3
Elec. Eng. 5.....	4	Mining 20.....	3
Geology 21.....	1	Mining 16.....	2
	<hr/> 16	Metallurgy 14.....	3
			<hr/> 16

CURRICULUM V IN MINING ENGINEERING

Leading to Degree of Bachelor of Science

	Hours.
Mathematics 1a, 2a, 3a, 4a.....	16
Chemistry 1, 2, 8b, 9.....	16
English 1a, 2a.....	4
Modern Foreign Language.....	12
Physics 1a, 1b, 2a, 2b.....	11
Civ. Eng. 1, 3, 4, 20, 28, 41, 42.....	23
Mech. Eng. 1, 3, 9.....	6
Electrical Eng. 5.....	4
Mining 4, 9, 1, 2, 7.....	12
Metallurgy 1, 2, 7.....	10
Pol. Science 1a.....	3
Elective	2
Geology 1b, 9, 13, 17, 21.....	17
Drill	8

GRADUATE COURSE IN MINING ENGINEERING

Following Option I and leading to the degree of Master of Science
in Mining Engineering

	Hours		Hours
Mining 10.....	3	Mining 22.....	1
Mining 6.....	1	Mining 7.....	1
Metallurgy 8.....	3	Mining 8.....	2
Mining 3.....	2	Metallurgy 4.....	3
Metallurgy 13.....	3	Geology 18.....	4
Elective, engineering.....	4	Elective, engineering.....	3
Mining 21.....	1	Mining 11.....	2
	<hr/> 16+1		<hr/> 16

* Required in all curricula.

Equivalent courses in Coal Mining Engineering may be substituted for those listed above.

The degree of Master of Science in Mining Engineering will also be conferred upon graduates of this College or of other mining colleges of the first class who complete a year (32 credit hours) of graduate work, including a satisfactory thesis, with the grade of A or B. The candidate must also pass a formal examination open to all members of the faculty. The selection of work for this degree must in each case be approved by the head of the department in which the student majors.

VI. SHORT SESSION FOR MINING MEN

The nineteenth annual Short Session for mining men will open on January 3d, 1916, continuing until April 1. During this period each year twelve of the instructors in mining engineering offer a course for the benefit of persons who are interested in prospecting, mining, smelting, clay or metal-working. Admission to the classes is without examination. Instruction is given by lectures, laboratory exercises, and visits to mines and plants in operation. The past experience and future aims of each student are taken into consideration, and the character of his work arranged accordingly.

No preparation is needed for this course. Many practical men with an interest in some branch of mining but without much education have obtained satisfactory results from the course; others with a college education and mining experience have gained much up-to-date training and information. Practically all the students attend the following subjects: Mining, field trips, mineralogy, geology, mining law; in addition to these subjects, fire assaying and general chemistry are studied by many of the quartz miners, while the placer men substitute placer mining and surveying. Assaying is accompanied by chemistry and mineralogy. Students who satisfactorily complete a course of study are given a certificate stating the amount and character of work done. For students who return a second year, a special course is arranged in continuation of their previous work.

The advantages of the University laboratories and libraries are open to all. Students may board and room at the dormitories or elsewhere, as preferred. A University fee of \$10.00 is paid by all students in the short sessions. There are no other charges,

except for material used. Deposits are made to cover the actual cost of supplies drawn by each student, the balance of the deposit being returned at the end of the course. All deposits are made at the beginning of the course.

TIME SCHEDULE FOR SHORT SESSION

Day	8:00	9:00	10:00	11:00	1:5
Monday	Survey	Geology	Mineralogy	Assaying	Surveying
Tuesday	Placer	Chemistry	Milling	Mining	Mining and Milling
Wednesday	Survey	Geology	Mineralogy	Assaying	
Thursday	Placer	Chemistry	Milling	Assay	Assaying
Friday	Mining	Chemistry	Mining		Chemistry
Saturday	Law				
	Surveying				

SUBJECTS IN THE SHORT SESSION

MINING 50. Lectures on prospecting, development, boring, air-compression, drilling, mining systems, timbering and transportation. Practice in air-compression, machine-drilling and sampling. Study of mine maps, ore deposits and mining districts. Two lectures and one laboratory period a week. Professor ROBERTS.

MINING 51. Milling. Lectures and recitations on ore treatment and concentration. Laboratory practice in sampling, testing, and dressing, using breakers, rolls, screens, stamp battery, tables, vanners, jigs, and accessory machinery. Two lectures and one afternoon a week. Assistant Professor DANIELS.

MINING 52. Field Trips. An outline study of the operations at neighboring mines, mills, and smelters; geological field studies, followed by laboratory practice on the rocks and minerals found. Saturdays. Professor ROBERTS and Assistant Professor DANIELS.

METALLURGY 53. Fire Assaying. Lectures on sampling, preparing ores for assay, furnaces, fuels, reagents, and the fire assay of gold, silver, lead, and tin ores. The laboratory work includes the testing of reagents, and the assaying of various ores. One lecture and three afternoons a week in laboratory. Deposit, fifteen dollars. Mr. CAMPBELL.

METALLURGY 54. A study of the principles of metallurgy for the benefit of those who are engaged in the metal trades or in the mining of ores requiring smelter treatment. Two lectures and one afternoon a week. Deposit, five dollars. Mr. CAMPBELL.

CHEMISTRY 1d. GENERAL CHEMISTRY AND QUALITATIVE ANALYSIS. Laboratory practice in the determination of the common elements. Three lectures a week, and one laboratory. Deposit, ten dollars. Professor BENSON.

GEOLOGY B. MINERALOGY. Instruction and practice in blow-pipe analysis, with lectures upon the common minerals, and practice in the identification of minerals by field tests. Twice a week. Deposit, two dollars. Assistant Professor CULVER.

GEOLOGY C. ELEMENTS OF GEOLOGY. Lectures on the elements of geology, the common varieties of rock, metalliferous vein and ore deposits, etc. Twice a week. Assistant Professor CULVER.

MINING 22. MINING LAW. A series of lectures on the mining laws of the United States and Alaska. Illustrated by drawings and mine maps. Once a week. Assistant Professor DANIELS and special lecturers.

CIVIL ENG. 19. SURVEYING. Instruction and field practice in the use of simple instruments for making underground and surface surveys; the elements of drawing, lettering, sketch-mapping and field notes; the rules governing mineral surveys. Two lectures and two laboratories a week. Deposit, \$3.00. Mr. NEWTON.

CIVIL ENG. 54. HYDRAULIC MINING. The elements of hydraulics; the flow of water in pipes, flumes and ditches; the methods and costs of placer mining in its various forms. Two lectures a week. Professor ALLISON.

MECHANICAL ENG. 3. FORGE. Practice in sharpening and tempering drill steel and picks; systematic training in the making and care of fires, and the application of various heats, drawing, punching, riveting, bending, twisting, upsetting, welding iron and steel, and making and tempering machine tools. Deposit, two dollars. One afternoon a week. Mr. KANE.

MECHANICAL ENG. 9. MINE TIMBER FRAMING. Shop work in the cutting, framing and erection of various types of timbers employed in mining operations. Deposit, two dollars. One afternoon a week. Mr. BEATTIE.

MINING 21. COAL MINING AND RESCUE TRAINING. For a description of the short courses in coal mining, first aid to the injured and rescue training, see under "Mine Rescue Training Station," page 314. Assistant Professor DANIELS and Government Engineers.

DEPARTMENTS OF INSTRUCTION

MINING ENGINEERING AND METALLURGY

(Mines Building)

PROFESSOR ROBERTS, ASSISTANT PROFESSOR DANIELS, ASSISTANT PROFESSOR COREY,* MR. CAMPBELL; LECTURERS, MR. MC ELVENNY, MR. POWELL, MR. GLENN; ASSISTANTS, MR. GLEASON, MR. SWEENEY, MR. WILCOX.

I. MINING ENGINEERING

Coal miners who are taking the ten days course in the U. S. Mine Rescue Training Station are given daily instruction and laboratory demonstrations in the subjects of mine gases, ventilation, the origin and composition of coals, and coal analysis.

1. MINING. Four credits. First semester. Prerequisite, senior standing. Deposit, \$3.00. Professor ROBERTS.

Three lectures and one laboratory period. Lectures on mining, power generation, air compression, hoisting and transportation. Practice with air compressors, machine drills and mine equipment in laboratories and local plants.

2. ORE DRESSING. Four credits. Second semester. Prerequisite, Mining 3. Senior or graduate. Deposit, \$5.00. Professor ROBERTS and Assistant Professor DANIELS, and Mr. WILCOX.

Two lectures and two laboratory periods. A detailed study of certain branches of ore dressing followed by a full test of ores by mill run checked by assays.

3. MILLING. Two credits. First semester. Prerequisite, junior standing. Deposit, \$3.00. Professor ROBERTS and Assistant Professor DANIELS, and Mr. WILCOX.

One lecture and one laboratory period. Lectures and mill practice in the principles of ore dressing.

4. MINE OPERATION. Two credits. First semester. Prerequisite, Sophomore standing. Assistant Professor DANIELS.

A general study of mine development and operation, considering particularly layout of plant, haulage, hoisting, pumping, etc. The Renton mine is studied in detail.

* Absent on leave, 1914-15.

5. FIELD WORK. One credit. First semester. Time to be arranged. Professor ROBERTS, and Assistant Professor DANIELS.

One laboratory period (or its equivalent in total time required) and monthly seminar. Class or individual visits to a mine, mill, smelter, or engineering work, to be followed by a report with field notes and sketches.

6. THESIS OUTLINE. One credit. First semester. One laboratory period. Professor ROBERTS, Assistant Professor DANIELS, and Mr. CAMPBELL.

The outlining of senior thesis, the gathering of material, study of references, making of drawings, maps, etc. See mining 8. Senior or graduate.

7. MINE INSPECTION. One credit. Second semester. Time to be arranged. Professor ROBERTS, Assistant Professor DANIELS, and Mr. CAMPBELL.

Ten days in the second semester. An excursion by the senior class to a mine or mining district.

8. THESIS. Two credits. Second semester. Two laboratory periods. Professor ROBERTS, Assistant Professor DANIELS, and Mr. CAMPBELL.

A continuation of Mining 6. Weekly consultation and seminars.

9. JUNIOR EXCURSION. One credit. Second semester. Required for senior standing. Professor ROBERTS, Assistant Professor DANIELS, and Mr. CAMPBELL.

An excursion by the junior class to a mine or mining district. Sometimes made in connection with the senior excursion, mining 7.

10. MINING METHODS. Three credits. First semester. Senior or graduate. Professor ROBERTS.

Two lectures and one laboratory period. A detailed study of certain branches of mining.

11. MINE MANAGEMENT. Two credits. Second semester. Prerequisite, senior or graduate standing. Assistant Professor DANIELS.

A study of the organization and administration of engineering plants, involving the keeping and interpretation of cost accounts, the efficiency of labor and methods, the financial, legal and social aspects of engineering operation.

12. COAL RESOURCES OF NORTH AMERICA. Two credits. Second semester. Two lectures. Prerequisite, Mining 4. Assistant Professor DANIELS.

The occurrence of coal in North America with especial reference to geographic and geologic distribution and structure; study of the various types of coals; classification of coals; commercial requirements of coals.

13. COAL MINING METHODS. Two credits. Second semester. Two lectures. Prerequisite, Mining 4. Assistant Professor DANIELS.

Methods of prospecting coal seams; determination of structure and content; methods of development and working, timbering, etc. A detailed study is made of a nearby mine.

14. MINE GASES AND VENTILATION. Two credits. First semester. Two lectures. Prerequisite, Mining 13. Assistant Professor DANIELS.

Composition and properties of mine gases, methods of testing. Lighting of mines. Principles of ventilation; ventilating machinery.

15. MINING PLANT. Three credits. First semester. Three drafting periods. Prerequisites, Mining 13, 14. Graduate. Assistant Professor DANIELS.

Design of plant and machinery employed in mining and preparing coal for market.

16. COAL MINING MACHINERY. Two credits. Second semester. Two lectures. Prerequisite, senior standing. Graduate. Assistant Professor DANIELS.

Study of coal cutting machines, mine locomotives, fans, hoists, pumps, and tippie or breaker machinery with special reference to application to coal mining.

20. COAL WASHING. Four credits. Second semester. Two lectures and two laboratory periods. Prerequisite, Mining 3. Graduate. Deposit, \$5.00. Assistant Professor DANIELS.

A detailed study of methods of preparing coal for market, together with laboratory tests and runs on various coal to determine best methods of preparation.

21. MINE RESCUE TRAINING. One credit. First semester. Twenty-five hours' instruction. Assistant Professor DANIELS.

Practice in the care and use of oxygen rescue apparatus, smoke-room training, and first-aid-to-the-injured work. Required of all students in the junior class.

22. MINING LAW. One credit. Second semester. One lecture. Assistant Professor DANIELS and special lecturers.

A series of lectures on the mining laws of the United States and Alaska, dealing particularly with the subject from the standpoint of the prospector, mining engineer and geologist. Illustrated by diagrams and mine maps.

24. INDUSTRIAL ORGANIZATION. Two credits. Second semester. Two lectures. Assistant Professor DANIELS.

A study of the principles of industrial organization and scientific management, involving the consideration of handling labor and materials, methods of operation, cost keeping and performance records, interpretation of efficiency data.

II. METALLURGY

1. FIRE ASSAYING. Four credits. First semester. Prerequisite, Chemistry 9. Deposit, \$15.00. Mr. CAMPBELL, Mr. GLENN and Mr. SWEENEY.

One lecture and three laboratory periods. The testing of reagents, the crushing, sampling and assaying of ores, furnace and mill products for lead, silver, gold and tin; also, the assay of base and gold bullion.

2. GENERAL METALLURGY. Four credits. Second semester. Deposit, \$10.00. Three lectures and one laboratory period. Professor ROBERTS, Mr. CAMPBELL and Mr. McELVENNY.

The properties of metals and alloys, fuels, refractory materials, furnaces and the extraction of the common metals from their ores. Visits to smelter.

3. METALLURGICAL FUELS. Two credits. First semester. Deposit, \$5.00. Assistant Professor DANIELS.

One lecture and one laboratory period. The composition, manufacture and metallurgical uses of natural and prepared fuels; the methods and costs of coking, gas making, and coal briquetting. Furnace and calorimeter tests of various types of fuels.

4. COPPER AND LEAD. Three credits. Second semester. Mr. CAMPBELL.

Three lectures. The metallurgy of copper and lead, especially the methods of roasting, smelting and refining.

5. **GOLD AND SILVER.** Three credits. First semester. Deposit, \$5.00. Two lectures and one laboratory period. Mr. CAMPBELL.

Amalgamation, cyaniding, and chlorination of gold and silver ores. Complete tests checked by assays.

6. **MINOR METALS.** Three credits. Second semester. Two lectures and one laboratory period. Deposit, \$5.00. Mr. CAMPBELL.

The metallurgy of zinc, antimony, tin, aluminum, nickel, etc.; a study of the plant required, the methods and costs of treatment.

7. **WET ASSAYING.** Three credits. First Semester. One lecture. Two laboratory periods. Prerequisite, Chemistry 9. Deposit, \$10.00. Mr. CAMPBELL.

Technical methods for the determination of copper, lead, zinc, etc., in ores and furnace products, etc.

8. **METALLURGICAL ANALYSIS.** Three credits. Second semester. One lecture. Two laboratory periods. Prerequisite, Chemistry 9. Deposit, \$10.00. Mr. CAMPBELL.

Technical methods of analysis of slags and industrial products.

9. **PYROMETRY AND ALLOYS.** Two credits. Second semester. One lecture and one laboratory period. Deposit, \$3.00. Mr. CAMPBELL.

Methods of measuring high temperatures. Union of metals by fusion, compression and electro-deposition; the behavior of metals and alloys under heat. Laboratory practice in thermal measurements, synthesis and testing of alloys.

10. **METALLOGRAPHY.** Two credits. First semester. One lecture and laboratory period. Deposit, \$3.00. Assistant Professor DANIELS.

The constitution and microstructure of metals and alloys, especially iron and steel. The preparation and study of metal sections, photomicrography and the use of the microscope to aid in testing structural iron and steel.

11. **METALLURGICAL PROBLEMS.** One credit. First semester. Prerequisites, Chemistry 9, and Metallurgy 2. Mr. CAMPBELL.

Physical chemistry for the metallurgist, slag calculations, etc., illustrated by figures quoted from the present practice at a number of smelting plants.

12. REFRACTORIES. Three credits. Second semester. One lecture and two laboratory periods. Deposit, \$3.00. Mr. CAMPBELL. Methods of testing clays, refractory materials, cement-making materials.

13. DESIGN OF PLANT. Three credits. Either semester. Three drafting periods. Senior or graduate. Professor ROBERTS and Assistant Professor DANIELS.

The designing of a piece of equipment or a structure for mining, milling or metallurgical purposes.

14. IRON AND STEEL. Three credits. Second semester. Three lectures. Assistant Professor DANIELS.

The metallurgy and manufacture of commercial iron and steel, with special reference to their properties and uses in engineering work.

THESIS. See Mining 6 and 8.

SUMMER FIELD WORK. See Mining 7 and 8.

SUBJECTS PRESENTED BY DEPARTMENTS IN OTHER
COLLEGES OF THE UNIVERSITY
CHEMISTRY
(Bagley Hall)

1, 2. GENERAL CHEMISTRY. Four credits. The year. Text-books, Smith's College Chemistry and Laboratory Manual. Deposit \$10.00. Professor BYERS, Instructors and Assistants.

1a, 2a. GENERAL CHEMISTRY. Four credits. The year. Consists of two lectures and six laboratory hours per week. Text-books, Smith's General Chemistry, Smith's Laboratory Manual, and Byers and Knight's Qualitative Analysis. Prerequisite, one year high school chemistry. Deposit \$10.00. Professor BYERS, Dr. TRUMBULL and Assistants.

1b. GENERAL CHEMISTRY. Four credits. Second semester. Repetition of 1a. Assistant Professor ROSE.

Strong students or those carrying light course will be permitted to elect this course without the prerequisite high school course; but to satisfy the required work of the engineering curricula, such students must elect some other four-hour course in the department of chemistry.

2b. GENERAL CHEMISTRY. Four credits. First semester. Continuation of 1b. Assistant Professor ROSE.

1d. PROSPECTOR'S COURSE. Four credits. Deposit, \$10.00. Professor BENSON.

For miners who may enter January 1, and will continue to April 1. Does not require previous knowledge of chemistry, and will be merged into a course of qualitative analysis. The text is Brownlee.

9-9. QUANTITATIVE ANALYSIS. Four credits. Either semester. Laboratory deposit \$10.00. Olson's Quantitative Analysis. Twelve laboratory hours and one recitation per week. Dr. BELL.

CIVIL ENGINEERING (Engineering Building)

1. ENGINEERING DRAWING. Two credits. Either semester. All freshman engineers. Prerequisite, plane geometry. Mr. WARNER, Mr. MAY, Mr. STRANDBERG, and ———.

Linear drawing, Roman and Gothic capital letters; free hand lettering.

3. ENGINEERING DRAWING. Four credits. Either semester. All freshman engineers. Prerequisite, solid geometry and C. E. 1. Mr. WARNER, Mr. STRANDBERG, and Mr. ———.

The elements of descriptive geometry, including the principles of shades, shadows and perspective. Practical problems.

4. ENGINEERING DRAWING. Two credits. Either semester. All sophomore engineers. Prerequisite, 3. Mr. WARNER, Mr. STRANDBERG, and Mr. ———.

Continuation of Drawing 3. Problems and tracing.

20. ELEMENTARY PLANE SURVEYING. Four credits. Either semester. All freshman engineers. Prerequisites, Math. 1a and C. E. 1. Laboratory deposit, \$3.00. Assistant Professor MILLER, Mr. DUCKERING, and Mr. ———.

Theory and use of chain, compass, transit and level. Adjustment of instruments. United States Public Land Surveys. Maps and computation of areas.

23. TOPOGRAPHIC SURVEYING. Three credits. The year. Junior civil and mining engineers. Prerequisites, Math. 3a and C. E. 21. Laboratory deposit, \$3.00. Assistant Professor MILLER.

Base line measurement. Reading and adjusting and computing triangulation systems. Topographic surveying, including plane-table, photography and cartography.

28. MINE SURVEYING. Three credits. First semester. Sophomore mining engineers. Prerequisite, C. E. 20. Laboratory deposit, \$3.00. Mr. NEWTON.

Surface and underground practice. Observation for meridian. Topography. Mining claim surveys. Plane triangulation. Tunnel and vertical shaft work and connections. Mapping.

41-42. MECHANICS. 41, four credits, the year. 42, three credits. All junior engineers. Prerequisites, Math. 4a, physics 1a. Professor MORE, Assistant Professor MACINTIRE and Mr. MAY. Statics, dynamics and mechanics of materials.

50. HYDRAULICS. Four credits. Second semester. All junior engineers. Prerequisite, 41. Assistant Professor HARRIS and Mr. STRANDBERG.

Flow of water through pipes and orifices, over weirs and in open channels; energy, impulse and reaction of jets with application to impulse wheels. Review of hydrostatics.

54. HYDRAULIC MINING. (Short session in mining, January-March.) Professor ALLISON.

A course of two lectures per week on the theory and practice of hydraulic mining.

ELECTRICAL ENGINEERING

(Engineering Building)

5. ELECTRICAL ENGINEERING. Four credits. The year. Prerequisites, Math. 4a; Physics 2a, 2b. Laboratory deposit, \$3.00. Mr. CURTIS and Mr. JOHNSON, Assistant Professor LOEW.

A short course giving the fundamental principles of direct currents with experimental tests on commercial dynamos and motors.

ENGLISH

(Office, Rooms 45 and 42, Denny Hall)

1a-2a. FRESHMAN COMPOSITION. Two credits. First semester of freshman and second semester of sophomore year. Associate Professor MILLIMAN in charge.

No students will be excused from the course, but a section will be provided for those whose training has been exceptionally good.

GEOLOGY

(Science Hall)

1b. GEOLOGY FOR MINING STUDENTS. Four credits. Either semester. Required course for freshmen. Laboratory deposit, \$1.00. Assistant Professor CULVER.

9. MINERALOGY. Four credits. Second semester. Two laboratory periods. Descriptive and determinative mineralogy. Laboratory deposit, \$2.00. Assistant Professor CULVER.

13. OPTICAL CRYSTALLOGRAPHY. Four credits. First semester. Two recitations and two laboratory periods per week. Laboratory deposit, \$2.00. Assistant Professor WEAVER.

16. PETROLOGY. Three credits. First semester. One recitation and two laboratory periods. Laboratory deposit, \$2.00. For coal mining engineers. Assistant Professor WEAVER.

A study of the principal types of rocks and practice in their determination by field methods.

17. PETROGRAPHY. Four credits. Second semester. Prerequisites, 1a, 9, 13. Laboratory deposit, \$2.00. Assistant Professor WEAVER.

A study of the distinguishing characteristics of the different groups and species of rocks with practice in their determination by modern petrographical methods.

18. ECONOMIC GEOLOGY. Four credits. Second semester. Four recitations per week. Professor LANDES.

19. PALEONTOLOGY. Four credits. First semester. Three recitations and one laboratory period per week. Chiefly for students in geology and mining. Assistant Professor WEAVER.

20. FIELD WORK. One credit. First semester.

21. FIELD WORK. One credit. Second semester. Professor LANDES, Assistant Professors SAUNDERS, WEAVER and CULVER.

GEOLOGY B. MINERALOGY. Short session in mining, January-March. Instruction and practice in blowpipe analysis, with lectures upon the common minerals, and practice in the identification of minerals by field tests. Twice a week. Deposit \$2.00. Assistant Professor CULVER.

GEOLOGY C. ELEMENTS OF GEOLOGY. Short session in mining January-March. Lectures on the elements of geology, the common varieties of rock, metalliferous vein and ore deposits, etc. Twice a week. Assistant Professor CULVER.

MATHEMATICS

(Science Hall)

O-O. SOLID GEOMETRY.. Three credits. Either semester. Prerequisite, Plane Geometry.

Required during the freshman year of all students in the colleges of Engineering, Forestry and Mines who do not offer solid geometry for admission.

1a. TRIGONOMETRY AND ALGEBRA. Four credits. First or second semester. Prerequisites, same as for Math. 1-2.

Primarily for students in the colleges of Engineering, Forestry, and Mines. The elements of plane trigonometry and supplementary work in algebra equivalent to one hour per week.

2a. ANALYTICAL GEOMETRY AND ALGEBRA. Four credits. First or second semester. Prerequisite, Math. 1a.

Primarily for students in the colleges of Engineering, Forestry, and Mines. The elements of analytical geometry and supplementary work in algebra equivalent to one hour per week.

3a. CALCULUS FOR ENGINEERS. Four credits. First or second semester.

4a. CALCULUS FOR ENGINEERS. Four credits. First or second semester.

Continuation of Math. 3a.

5a. APPLICATION OF THE CALCULUS FOR ENGINEERS. Two credits. First or second semester. Prerequisite, Math. 4a.

MECHANICAL ENGINEERING

(Office, Engineering Building)

1. CARPENTRY AND WOODTURNING. Two credits. The year. Deposit \$2.00. Mr. BEATTIE.

3. FORGE AND FOUNDRY. Two credits. The year. Deposit \$2.00. Mr. KANE.

4. MACHINE WORK. Two credits. The year. Deposit \$2.00. Mr. KANE.

9. MINE TIMBER FRAMING. Two credits. Second semester. Deposit \$2.00. Mr. BEATTIE, Assistant Professor DANIELS.

MILITARY SCIENCE AND TACTICS

(Office, The Armory)

EDWARD E. MCCAMMON, FIRST LIEUTENANT THIRD INFANTRY, U. S. A.,
COMMANDANT

A course of two years in military training is required. All able-bodied male students (except those from foreign countries, not intending to become naturalized) must take the course, which by regulation of the University is required during the first and second years. Three hours a week are devoted to military training, for which two credits are given each semester.

PHYSICS

(Basement, Denny Hall)

1a. MECHANICS AND WAVE MOTION. Four credits. First or second semester. Prerequisite, 8 hours in mathematics. This course must be accompanied by 1b. Assistant Professor BRAKEL and Dr. ANDERSON.

2a. LIGHT, HEAT, ELECTRICITY. Four credits. First or second semester. This course must be accompanied by 2b. Assistant Professor BRAKEL and Dr. ANDERSON.

1b. PHYSICS MEASUREMENTS. Two credits. First or second semester. One four-hour laboratory period. Six dollars deposit per year. Mr. VORIS.

2b. PHYSICS MEASUREMENTS. One credit. First or second semester. One three-hour laboratory period. Six dollars deposit per year. Mr. VORIS.

POLITICAL AND SOCIAL SCIENCE

(Denny Hall)

1a. ELEMENTS OF ECONOMICS. Three credits. First or second semester.

The Bulletin of the University of Washington
includes the following publications:

ENTRANCE INFORMATION
THE CATALOGUE
BULLETINS OF
COLLEGE OF LIBERAL ARTS
COLLEGE OF SCIENCE
COLLEGE OF EDUCATION
COLLEGE OF ENGINEERING
COLLEGE OF FINE ARTS
COLLEGE OF FORESTRY
SCHOOL OF LAW
COLLEGE OF MINES
COLLEGE OF PHARMACY
GRADUATE SCHOOL
EXTENSION DIVISION
SUMMER SESSION
PUGET SOUND MARINE STATION

Requests for bulletins, or for general information in regard to the University, and all credentials and correspondence relative to admission or advanced standing should be addressed to THE RECORDER, University of Washington, Seattle, Washington.

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BULLETIN

University of Washington

SERIES I

APRIL, 1916

No. 99—PART 7

College of Mines

1916—1917

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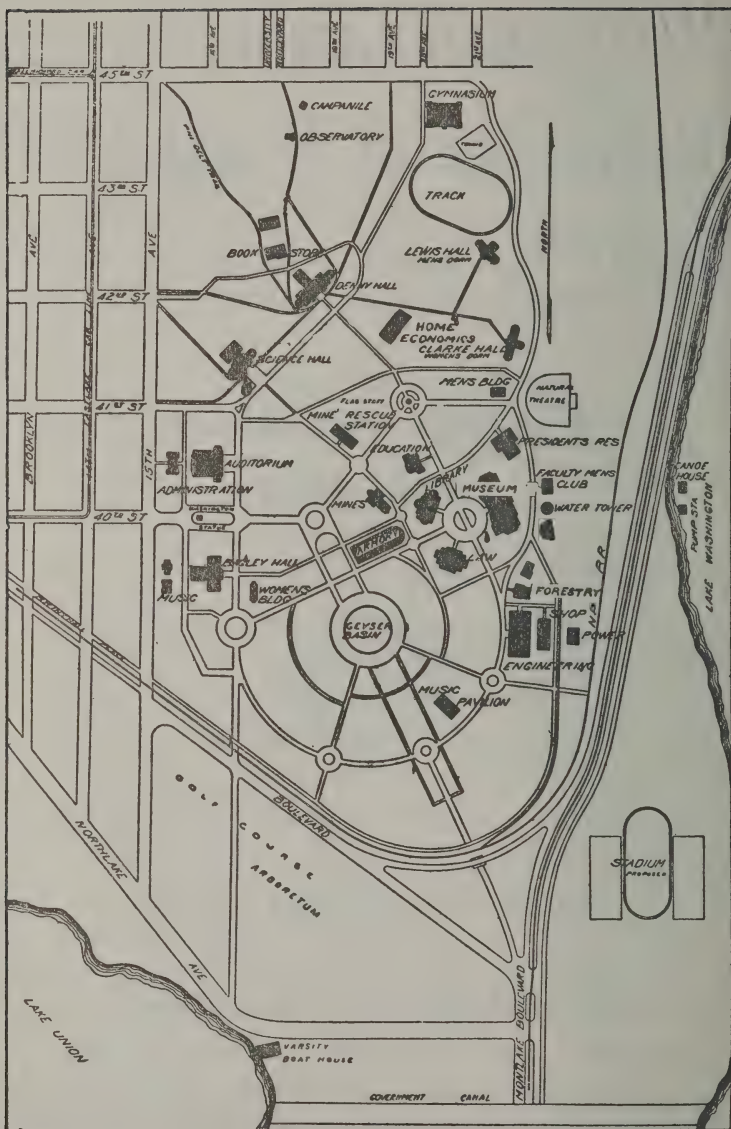
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SEATTLE, WASHINGTON

Published Quarterly by the University

1916

Entered as second class matter at Seattle, under the act of July 16, 1894



UNIVERSITY CALENDAR

1916-1917

Summer sessionJune 19 to July 28

FIRST SEMESTER

Examinations for admission and for exemption from College English.. { Thursday, Friday and Saturday, September 7, 8, 9, at 9 a. m. and 2 p. m.

Registration days....Monday and Tuesday, September 11 and 12

Instruction begins.....Wednesday, September 13

President's annual address.....Friday, September 15, 10 a. m.

Women's assembly.....Friday, September 22, 11 a. m.

Assembly of the Associated Students.....
.....Wednesday, September 27, 9 a. m.

Thanksgiving vacation..... { Wednesday, November 29, 6 p. m.,
to Monday, December 4, 8 a. m.

Assembly of the Associated Students.....
.....Wednesday, December 6, 1 p. m.

Christmas vacation..... { Friday, December 15, 6 p. m., to
Tuesday, January 2, 8 a. m.

Semester examinations { Monday, Tuesday, Wednesday, Thursday,
Friday, January 22, 23, 24, 25, 26

SECOND SEMESTER

Registration days.....Monday and Tuesday, January 29 and 30

Instruction begins.....Wednesday, January 31

Women's assembly.....Friday, February 2, 11 a. m.

Washington's birthday (holiday).....Thursday, February 22

Spring vacation..... { Friday, March 30, 6 p. m., to
Monday, April 9, 8 a. m.

Assembly of the Associated Students..Thursday, April 12, 9 a. m.

Campus day.....Friday, April 27

Junior day.....Saturday, May 5

Memorial day (holiday).....Wednesday, May 30

Semester examinations. { Monday, Tuesday, Wednesday, Thursday,
Friday, Saturday, June 4, 5, 6, 7, 8, 9

Baccalaureate Sunday.....June 10

Class day and President's reception.....Monday, June 11

Alumni day.....Tuesday, June 12

Commencement.....Wednesday, June 13

THE BOARD OF REGENTS

OSCAR A. FECHTER, President.....	North Yakima
Term ends March, 1922.	
CHARLES E. GACHES.....	Mount Vernon
Term ends March, 1917.	
WILLIAM A. SHANNON.....	Seattle
Term ends March, 1917.	
WINLOCK W. MILLER.....	Seattle
Term ends March, 1920.	
WILLIAM T. PERKINS.....	Seattle
Term ends March, 1920.	
ELDRIDGE WHEELER	Montesano
Term ends March, 1921.	
JOHN A. REA.....	Tacoma
Term ends March, 1922.	
WILLIAM MARKHAM, Secretary to the Board.	

OFFICERS OF ADMINISTRATION

THE UNIVERSITY

HENRY SUZZALLO, PH. D., President of the University, Administration Building.

HERBERT THOMAS CONDON, LL. B., Comptroller and Bursar, Administration Building.

EDWARD NOBLE STONE, A. M., Registrar and Recorder, Administration Building.

EDWIN BICKNELL STEVENS, A. M., Executive Secretary, Administration Building.

ARTHUR RAGAN PRIEST, A. M., Dean of Men, Administration Building.

ETHEL HUNLEY COLDWELL, A. M., Dean of Women, Denny Hall.

WILLIAM ELMER HENRY, A. M., Librarian, Library Building.

EVERETT OWEN EASTWOOD, C. E., Consulting Engineer, Engineering Building.

DAVID CONNOLLY HALL, M. D., University Health Officer, Gymnasium.

FRANK STEVENS HALL, Curator of the Museum, Forestry Building.

THE COLLEGES AND SCHOOLS

ARTHUR SEWALL HAGGETT, PH. D., Dean of the College of Liberal Arts, Denny Hall.

ALMON HOMER FULLER, M. S., C. E., Dean of the College of Engineering, Engineering Building.

MILNOR ROBERTS, A. B., Dean of the College of Mines, Mines Building.

CHARLES WILLIS JOHNSON, PH. C., PH. D., Dean of the College of Pharmacy, Bagley Hall.

JOHN THOMAS CONDON, LL. M., Dean of the School of Law, Law Building.

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*HENRY LANDES, A. M., Dean of the College of Science.

THEODORE CHRISTIAN FRYE, PH. D., Acting Dean of the College of Science, Science Hall.

FREDERICK ELMER BOLTON, PH. D., Dean of the College of Education, Education Building.

IRVING MACKEY GLEN, A. M., Dean of the College of Fine Arts, Meany Hall.

THE EXTENSION DIVISION

EDWIN AUGUSTUS START, A. M., Director, Administration Building.

* Absent on leave, 1915-16.

COLLEGE OF MINES

THE FACULTY

HENRY SUZZALLO, PH. D. (Columbia), PRESIDENT.

MILNOR ROBERTS, A. B. (Stanford), Professor of Mining Engineering and Metallurgy; DEAN.

ALMON HOMER FULLER, M. S., C. E. (Lafayette), Professor of Civil Engineering.

JOHN THOMAS CONDON, LL. M. (Northwestern), Professor of Law.

HORACE G. BYERS, PH. D. (Johns Hopkins), Professor of Chemistry.

TREVOR KINCAID, A. M. (Washington), Professor of Zoology.

FREDERICK ARTHUR OSBORN, PH. D. (Michigan), Professor of Physics.

ROBERT EDOUARD MORITZ, PH. D. (Strassburg), Professor of Mathematics and Astronomy.

CARL EDWARD MAGNUSSON, PH. D., E. E. (Wisconsin), Professor of Electrical Engineering.

EVERETT OWEN EASTWOOD, C. E., A. M. (Virginia), Professor of Mechanical Engineering.

DAVID CONNOLLY HALL, SC. M., M. D. (Chicago), Director of Physical Education for Men.

WILLIAM FRANKLIN ALLISON, C. E. (Cornell), Professor of Municipal and Highway Engineering.

CHARLES CHURCH MORE, M. S., C. E. (Lafayette), Professor of Civil Engineering.

HENRY KREITZER BENSON, PH. D. (Columbia), Professor of Industrial Chemistry.

*FRANK MARION MORRISON, PH. D. (Chicago), Associate Professor of Mathematics.

LOREN DOUGLAS MILLIMAN, A. B. (Michigan), Associate Professor of English.

* Absent on leave, second semester 1915-16.

CHARLES W. HARRIS, C. E. (Cornell), Associate Professor of Civil Engineering.

JOSEPH DANIELS, S. B., M. S. (Lehigh), Assistant Professor of Mining Engineering and Metallurgy.

†VANDERVEER CUSTIS, PH. D. (Harvard), Assistant Professor of Economics.

GEORGE SAMUEL WILSON, B. S. (Nebraska), Assistant Professor of Mechanical Engineering.

EDGAR ALLEN LOEW, B. S. (Wisconsin), Assistant Professor of Electrical Engineering.

CLARENCE RAYMOND COREY, E. M., M. S. (Columbia), Assistant Professor of Mining Engineering and Metallurgy.

HENRY LOUIS BRAKEL, PH. D. (Cornell), Assistant Professor of Physics.

JOHN W. MILLER, B. S. (Nebraska), Assistant Professor of Civil Engineering.

GEORGE IRVING GAVETT, B. S., C. E. (Michigan), Assistant Professor of Mathematics.

CHARLES EDWARD WEAVER, PH. D. (California), Assistant Professor of Geology.

CHARLES EDWARD NEWTON, E. M. (Michigan), Instructor in Civil Engineering.

SAMUEL THOMAS BEATTIE, Instructor in Woodwork.

OTTO D. ROHLFS, E. M. (Columbia), Instructor in Mining, Short Session.

JESS C. JOHNSON, Assistant in Metallurgy

HENRY G. BOULTON, Assistant in Mining.

W. H. WHITTIER, Assistant in Stock Room.

HARVEY L. GLENN, B. S., Lecturer on Assaying of Bullion.

ROBERT F. McELVENNY, E. M., Lecturer on Copper Smelting.

FREDERICK POWELL, A. B., Lecturer on Gold Dredging.

† Absent on leave, 1915-16.

*ADMISSION TO FRESHMAN STANDING

A student must offer for admission to freshman standing in the University, fifteen units by examination or by certificate from an accredited school from which he has graduated. The fifteen units must include the following combinations:

- 3 units of English
- 2 units of mathematics (or 3 units if desired)
- 3 units selected from one of the following groups (or 2 units, if 3 units of mathematics are presented):
 - (a) Latin and Greek (not less than 2 units of Latin, or 1 of Greek will be counted).
 - (b) Modern foreign language (at least 2 units in *one* language; not less than one unit will be counted in any language).
 - (c) History, civics, economics (at least one unit to form a year of consecutive work in history).
 - (d) Physics, chemistry, botany, zoology, general biology, physical geography, geology, physiology. (Not less than one unit will be counted in physics, chemistry, or general biology. No science will be counted as applying on this requirement unless it includes a satisfactory amount of laboratory work).
- 2 units in subjects represented in the above groups (a)-(d)
- 5 units selected from any subjects accepted by an approved high school for its diploma; not more than 4 units, however, may be in vocational subjects.

In addition to the three units of English and the two units of mathematics required for admission to all colleges of the University, it is recommended that a student expecting to enter the College of Mines should elect his work from the groups (a) to (d), so as to offer the following subjects:

Advanced algebra	½ unit
Solid geometry	½ unit
Physics	1 unit
Chemistry (for four-year course only).....	1 unit
A foreign language.....	2 units
A history (or U. S. history and civics).....	1 unit

* More detailed information concerning admission is furnished in a separate section of the University Bulletin, known as Entrance Information. (See pages 9-13.)

If he shall not have included these subjects in his high school elections, it will be necessary for him to include them among his elections in college.

DEGREES

The four-year curricula in the College of Mines lead to the following degrees: Curriculum I, bachelor of science in mining engineering; curriculum II, bachelor of science in geology and mining; curriculum III, bachelor of science in metallurgical engineering; curriculum IV, bachelor of science in coal mining engineering.

In addition to the above, curriculum V, which leads to the degree of bachelor of science (B. S.), is offered. The entrance requirements for curriculum V are less technical than for the other curricula and the training given by it is broader. Students who graduate in this curriculum are advised to spend an additional year in study and research according to the schedule given for the degree of master of science in mining engineering (M. S. in Min. E.). A new curriculum in coal mining engineering is offered.

The degree of engineer of mines (E. M.) is given to graduates in mining engineering who have practiced their profession for at least three years, and who present a satisfactory thesis. Graduates in metallurgy may receive the degree of metallurgical engineer (Met. E.) under similar conditions.

MINING AND METALLURGICAL INDUSTRIES AVAILABLE FOR STUDY

Excellent opportunities for becoming familiar with mining and metallurgical operations are open to students in the College of Mines. The amount of time available during the college year for this purpose is not great and even by using the summer vacations it is impossible for a student to cover the whole field of local industries included in his chosen profession.

Mining machinery of the best type is in operation within easy reach of the University. Much of the heavy mining machinery used in the neighboring states and Alaska is built in the city of Seattle, while patented machines, such as drills and concentrating tables of all makes, are kept in stock and as working exhibits by the firms that supply the North Pacific coast regions. The application of hydraulic mining methods to city grading is being carried on locally on a very large scale and with the most

approved pumping and piping appliances and methods. Equally important to the mining engineer are the operations of the steam shovels, which are used largely now in iron, copper and gold mining. The engineers in charge of these plants have given the mining students every opportunity to become familiar with the methods of planning and carrying on the work, and the same statement applies to the mine operators throughout the state.

A brief list of the other available works of interest includes coal mines, with the largest production west of the Rocky mountains; metal mines of gold, silver, copper, arsenic, antimony, iron, etc.; cement plants, glass works, several stone quarries and dressing works; clay mines, clay and pottery works; gravel and sand pits with large production and approved methods; a region of varied geology with many economic minerals; the Tacoma and Everett smelters and refineries; the U. S. assay office; the West Seattle steel plant of the Pacific Coast Steel Co., and several plants engaged in metallurgical work.

MINING SOCIETY

The Mining Society, affiliated with the American Institute of Mining Engineers, has a membership composed of upperclassmen, graduate students and three sophomores, chosen for the excellence of their records in actual mining. At the monthly meetings of the society addresses are made by prominent mining engineers, and papers descriptive of their summer work are presented by the student members. The officers for 1915-1916 are Fred S. Porter, president; Jess C. Johnson, vice-president; Henry G. Boulton, secretary and treasurer; Cecil F. Blogg, corresponding secretary.

UNITED STATES MINE RESCUE TRAINING STATION

The United States Mine Rescue Training Station, operated in connection with the College of Mines, occupies a separate building. The "smokeroom" is the largest of its kind in the country, measuring 25 by 50 feet.

Several sets of various types of oxygen rescue and resuscitation apparatus are kept on hand for practice as well as for use in mine rescue work. The purpose of the station is to train miners in the use of oxygen helmets, which are used in cases of mine fires and explosions in both coal and metal mines. From ten days to two weeks' time is required for the course of training. The ap-

plicant is taught the construction of the apparatus and is required to wear it for four hours each day, in two periods of two hours each. The practice is carried on in a room filled with gas which cannot be breathed without immediate danger, and the work to be performed is the same as that which would be required in actual mining operations or rescue work. The smoke-room represents a portion of a mine, and is equipped with mine car, track, overcast, timbers and brick. First aid instruction is also given. Applicants who have completed the course of training receive a certificate from the U. S. Bureau of Mines.

INSTRUCTION FOR COAL MINING MEN

Miners taking the rescue training also receive instructions in the College of Mines on the subjects of mine gases, explosions, and the origin and distribution of Pacific Coast and Alaska coals. Laboratory experiments are carried on to show the methods of analyzing coals and determining the uses to which they may be put. The methods of testing for permissible explosives at the Pittsburg Station and the safe methods of charging, tamping and firing are explained.

CURRICULA IN THE COLLEGE OF MINES

FRESHMAN YEAR FOR ALL CURRICULA

FIRST SEMESTER	Credits	SECOND SEMESTER	Credits
Mathematics 51	4	Mathematics 52	4
Chemistry 21	4	Chemistry 22	4
Civil Engineering 1.....	2	Civil Engineering 6.....	4
English 3	2	Civil Engineering 20.....	4
Geology 3	4	Mechanical Engineering 4...	2
Mechanical Engineering 1...	2	Mil. Sci. or Phys. Ed.....	2
Mil. Sci. or Phys. Ed.....	2		
	<hr/> 16+4		<hr/> 16+4

SOPHOMORE YEAR FOR ALL CURRICULA

Mining 51	2	Geology 22	4
Civil Engineering 11.....	2	Chemistry 101	4
Civil Engineering 27.....	3	Physics 96	1
Physics 95	2	Physics 98	4
Physics 97	4	Mathematics 62	4
Mathematics 61	4	Mil. Sci. or Phys. Ed.....	2
Mil. Sci. or Phys. Ed.....	2		
	<hr/> 17+2		<hr/> 17+2

OPTION I IN MINING ENGINEERING

JUNIOR YEAR

FIRST SEMESTER	Credits	SECOND SEMESTER	Credits
*Mining 101	2	Mining 106	2
*Mining 103	1	Metallurgy 102	4
*Metallurgy 101	4	Electrical Engineering 105..	4
Civil Engineering 131.....	4	Geology 124	4
*Mechanical Engineering 53..	2	*Political Science 3.....	3
Geology 123	4	Mining practice in summer	
*English 4	2	vacation.	
	16+3		17

SENIOR YEAR

Mining 151	4	*Mining 152	4
Metallurgy 151	3	*Mining 154	2
Mining 153	1	*Mining 156	2
Metallurgy 153	2	Mining 158	1
Metallurgy 155	2	Metallurgy 157	3
Civil Engineering 143.....	4	Metallurgy 162	1
Geology 125	1	Geology 128	4
	17		17

OPTION II IN GEOLOGY AND MINING

JUNIOR YEAR

FIRST SEMESTER	Credits	SECOND SEMESTER	Credits
*Mining 101	2	*Mining 102	2
*Mining 103	1	*Metallurgy 102	4
*Metallurgy 101	4	Metallurgy 106	2
Metallurgy 103	2	Civil Engineering 107.....	3
Mechanical Engineering 53..	2	Geology 124	4
Geology 123	4	*English 4	2
Geology 125	1	Geology or mining practice	
*Political Science 3.....	3	in summer vacation.	
	16+3		17

SENIOR YEAR

*Mining 151	4	*Mining 152	4
*Mining 153	1	*Mining 154	2
Metallurgy 151	3	*Mining 156	2
Metallurgy 153	2	Mining 158	1
Metallurgy 155	2	Metallurgy 162	1
Geology 125	1	Geology 128	4
Geology 131	4	Geology 222	1
	17	Elective	2
			17

* Required in all curricula.

OPTION III IN METALLURGICAL ENGINEERING

JUNIOR YEAR

FIRST SEMESTER	Credits	SECOND SEMESTER	Credits
*Mining 101	2	*Mining 102	2
*Mining 103	1	*Metallurgy 102	4
*Metallurgy 101	4	Metallurgy 104	2
Metallurgy 103	2	Metallurgy 162	1
Metallurgy 155	2	Electrical Engineering 105...	4
*Mechanical Engineering 53.	2	Mechanical Engineering 54...	2
Civil Engineering 131.....	4	*Political Science 3.....	3
*English 4	2	Metallurgical practice in summer vacation.	
	<hr/> 16+3		<hr/> 16+2

SENIOR YEAR

*Mining 151	4	*Mining 152	4
*Mining 153	1	*Mining 154	2
Metallurgy 151	3	Mining 156	2
Metallurgy 157	3	Metallurgy 158	2
Metallurgy 163	1	Metallurgy 160	3
Metallurgy 165	1	Geology 128	4
Civil Engineering 143.....	4		
	<hr/> 17		<hr/> 17

OPTION IV IN COAL MINING ENGINEERING

JUNIOR YEAR

FIRST SEMESTER	Credits	SECOND SEMESTER	Credits
*Mining 101	2	*Mining 102	2
*Mining 103	1	Mining 120	2
*Metallurgy 101	4	Mining 122	2
Civil Engineering 131.....	4	*Metallurgy 102	4
*Mechanical Engineering 53.	2	Electrical Engineering 105...	4
Geology 121	3	*Political Science 3.....	3
*English 4	2	Summer practice in coal mining.	
	<hr/> 15+3		<hr/> 17

SENIOR YEAR

*Mining 151	4	*Mining 154	2
*Mining 153	1	*Mining 156	2
Mining 171	2	Mining 172	3
Civil Engineering 143.....	4	Mining 174	2
Mechanical Engineering 82..	2	Mining 176	3
Mechanical Engineering 140.	2	Mining 182	2
Geology 125	1	Metallurgy 155	2
	<hr/> 16		<hr/> 16

* Required in all curricula.

CURRICULUM V IN MINING ENGINEERING

Leading to the Degree of Bachelor of Science

	Credits
Mining 51, 102, 151, 152, 156.....	14
Metallurgy 101, 102, 153	9
Civil Engineering 1, 6, 11, 20, 27, 131, 143.....	23
Electrical Engineering 105.....	4
Mechanical Engineering 1, 4, 53.....	6
Chemistry 1, 2, 41, 101.....	16
Physics 95, 96, 97, 98.....	11
Mathematics 51, 52, 61, 62.....	16
Geology 3, 22, 123, 124, 125.....	17
English 3, 4.....	4
Political Science 3	3
Modern foreign language.....	12
Elective	2
Military Science or Physical Education.....	8

GRADUATE COURSE IN MINING ENGINEERING

Following Option I and leading to the Degree of Master of Science
in Mining Engineering

FIRST SEMESTER	Credits	SECOND SEMESTER	Credits
Mining 101	2	Mining 154	2
Mining 103	1	Mining 156	2
Mining 153	1	Mining 158	1
Mining 301	3	Mining 182	2
Metallurgy 157	3	Metallurgy 104	2
Metallurgy 160	3	Geology 128	4
Elective (engineering)	4	Elective (engineering)	4
	16+1		17

Equivalent courses in Coal Mining Engineering may be substituted for those listed above.

The degree of Master of Science in Mining Engineering will also be conferred upon graduates of this College or of other mining colleges of the first class who complete a year (34 credit hours) of graduate work, including a satisfactory thesis, with the grade of A or B. The candidate must also pass a formal examination open to all members of the faculty. The selection of work for this degree must in each case be approved by the head of the department in which the student majors.

VI. SHORT SESSION FOR MINING MEN

The twentieth annual Short Session for mining men will open on January 2nd, 1917, continuing until April 1. During this period each year twelve of the instructors in mining engineering offer a course for the benefit of persons who are interested in prospecting, mining, milling, assaying or smelting. Admission

to the classes is without examination. Instruction is given by lectures, laboratory exercises, and visits to mines and plants in operation. The past experience and future aims of each student are taken into consideration, and the character of his work arranged accordingly.

No preparation is needed for this course. Many practical men with an interest in some branch of mining but without much education have obtained satisfactory results from the course; others with a college education and mining experience have gained much up-to-date training and information. Practically all the students attend the following subjects: Mining, field trips, mineralogy, geology, mining law; in addition to these subjects, fire assaying and general chemistry are studied by many of the quartz miners while the placer men substitute placer mining and surveying. Assaying is accompanied by chemistry and mineralogy. Students who satisfactorily complete a course of study are given a certificate stating the amount and character of work done. For students who return a second year, a special course is arranged in continuation of their previous work.

The advantages of the University laboratories and libraries are open to all. Students may board and room at the dormitories or elsewhere, as preferred. A University fee of \$10.00 is paid by all students in the short sessions. There are no other charges, except for material used. Deposits are made to cover the actual cost of supplies drawn by each student, the balance of the deposit being returned at the end of the course. All deposits are made at the beginning of the course.

TIME SCHEDULE FOR SHORT SESSION

Day	8:00	9:00	10:00	11:00	1:5
Monday	Survey	Geology	Mineralogy	Assaying	Surveying
Tuesday	Placer	Chemistry	Milling	Mining	Mining and Milling
Wednesday	Survey	Geology	Mineralogy	Assaying	
Thursday	Placer	Chemistry	Milling	Assay	Assaying
Friday	Min. Law	Chemistry	Mining		Chemistry
Saturday	Surveying				

SUBJECTS IN THE SHORT SESSION

MINING S. C. 1. Lectures on prospecting, development, boring, air-compression, drilling, mining systems, timbering and transportation. Practice in air-compression, machine-drilling and sampling. Study of mine maps, ore deposits and mining dis-

tricts. Two lectures and one laboratory period a week. Professor ROBERTS.

MINING S. C. 2. Milling. Lectures and recitations on ore treatment and concentration. Laboratory practice in sampling, testing, and dressing, using breakers, rolls, screens, stamp battery, tables, vanners, jigs, and flotation machinery. Two lectures and one afternoon a week. Assistant Professor DANIELS.

MINING S. C. 3. Field Trips. An outline study of the operations at neighboring mines, mills, and smelters; geological field studies, followed by laboratory practice on the rocks and minerals found. Saturdays. Professor ROBERTS and Assistant Professor DANIELS.

METALLURGY S. C. 1. Fire Assaying. Lectures on sampling, preparing ores for assay, furnaces, fuels, reagents, and the fire assay of gold, silver and lead ores. The laboratory work includes the testing of reagents, and the assaying of various ores. One lecture and three afternoons a week in laboratory. Deposit, \$15.00. Assistant Professor COREY.

METALLURGY S. C. 2. A study of the principles of metallurgy for the benefit of those who are engaged in the metal trades or in the mining of ores requiring smelter treatment. Two lectures and one afternoon a week. Deposit, \$5.00. Assistant Professor COREY.

CHEMISTRY S. C. 3. GENERAL CHEMISTRY AND QUALITATIVE ANALYSIS. Laboratory practice in the determination of the common elements. Three lectures a week, and one laboratory. Deposit, \$10.00. Professor BENSON.

GEOLOGY S. C. 2. MINERALOGY. Instruction and practice in blow-pipe analysis, with lectures upon the common minerals, and practice in the identification of minerals by field tests. Twice a week. Deposit, \$2.00. Mr. PACKARD.

GEOLOGY S. C. 3. ELEMENTS OF GEOLOGY. Lectures on the elements of geology, the common varieties of rock, metalliferous vein and ore deposits, etc. Twice a week. Mr. PACKARD.

MINING LAW. A series of lectures on the mining laws of the United States and Alaska. Illustrated by drawings and mine maps. Twice a week for one-half semester.

SURVEYING. (C. E. 38.) Instruction and field practice in the use of simple instruments for making underground and surface surveys; the elements of drawing, lettering, sketch-mapping and field notes; the rules governing mineral surveys. Two lectures and two laboratories a week. Deposit, \$3.00. Mr. NEWTON.

HYDRAULIC MINING. (C. E. 144.) The elements of hydraulics; the flow of water in pipes, flumes and ditches; the methods and costs of placer mining in its various forms. Two lectures a week. Professor ALLISON.

FORGE. Practice in sharpening and tempering drill steel and picks; systematic training in the making and care of fires, and the application of various heats, drawing, punching, riveting, bending, twisting, upsetting, welding iron and steel, and making and tempering machine tools. Deposit, \$2.00. One afternoon a week. Mr. KANE.

MINE TIMBER FRAMING. Shop work in the cutting, framing and erection of various types of timbers employed in mining operations. Deposit, \$2.00. One afternoon a week. Mr. BEATTIE and Assistant Professor DANIELS.

MINING. 103. COAL MINING AND RESCUE TRAINING. For a description of the short courses in coal mining, first aid to the injured and rescue training, see under "Mine Rescue Training Station," pages 10-11. Assistant Professor DANIELS and Government engineers.

DEPARTMENTS OF INSTRUCTION

MINING ENGINEERING AND METALLURGY

(Mines Building)

PROFESSOR ROBERTS, ASSISTANT PROFESSORS DANIELS AND COREY, MR. ROHLFS; LECTURERS, MR. MC ELVENNY, MR. POWELL, MR. GLENN; ASSISTANTS, MR. WHITTIER, MR. BOULTON, MR. JOHNSON.

I. MINING ENGINEERING

Coal miners who are taking the ten days course in the U. S. Mine Rescue Training Station are given daily instruction and laboratory demonstrations in the subjects of mine gases, ventilation, the origin and composition of coals, and coal analysis.

51. ELEMENTS OF MINING. Two credits. First semester. Prerequisite, sophomore standing. Assistant Professor DANIELS.

A general study of mine development and operation, considering particularly layout of plant, haulage, hoisting, pumping, etc. The Renton mine is studied in detail.

101. MILLING. Two credits. First semester. Prerequisite, junior standing. Deposit, \$3.00. Professor ROBERTS, Assistant Professor DANIELS and Mr. JOHNSON.

One lecture and one laboratory period. Lectures and mill practice in the principles of ore dressing.

103. MINE RESCUE TRAINING. One credit. First semester. Twenty-five hours' instruction. Assistant Professor DANIELS and Government engineers.

Practice in the care and use of oxygen rescue apparatus, smoke-room training, and first-aid-to-the-injured work at the U. S. Bureau of Mines Rescue Station. Required of all students in the College of Mines.

106. JUNIOR EXCURSION. Two credits. Second semester. Required for senior standing. Professor ROBERTS, Assistant Professors DANIELS and COREY.

An excursion by the junior class to a mine or mining district. Sometimes made in connection with the senior excursion, Mining 156.

120. COAL RESOURCES OF NORTH AMERICA. Two credits. Second semester. Two lectures. Prerequisite, Mining 51. Assistant Professor DANIELS.

The occurrence of coal in North America with especial reference to geographic and geologic distribution and structure; study of the various types of coals; classification of coals; commercial requirements of coals.

122. COAL MINING METHODS. Two credits. Second semester. Two lectures. Prerequisite, Mining 51. Assistant Professor DANIELS.

Methods of prospecting coal seams; determination of structure and content; methods of development and working, timbering, etc. A detailed study is made of a nearby mine.

151. MINING ENGINEERING. Four credits. First semester. Prerequisite, senior standing. Deposit, \$3.00. Professor ROBERTS.

Three lectures and one laboratory period. Lectures on mining, power generation, air compression, hoisting and transportation. Practice with air compressors, machine drills and mine equipment in laboratories and local plants.

152. ORE DRESSING. Four credits. Second semester. Prerequisite, Mining 101. Senior or graduate. Deposit, \$5.00. Professor ROBERTS, Assistant Professor DANIELS and Mr. JOHNSON.

Two lectures and two laboratory periods. A detailed study of certain branches of ore dressing followed by a full test of ores by mill run checked by assays.

153. THESIS OUTLINE. One credit. First semester. One laboratory period. Professor ROBERTS, Assistant Professors DANIELS and COREY.

The outlining of senior thesis, the gathering of material, study of references, making of drawings, maps, etc. See Mining 154. Senior or graduate.

154. THESIS. Two credits. Second semester. Two laboratory periods. Professor ROBERTS, Assistant Professors DANIELS and COREY.

A continuation of Mining 153. Weekly consultation and seminars.

155. FIELD WORK. One credit. First semester. Time to be arranged. Professor ROBERTS and Assistant Professor DANIELS.

One laboratory period (or its equivalent in total time required) and monthly seminar. Class or individual visits to a mine, mill, smelter, or engineering work, to be followed by a report with field notes and sketches.

156. MINE INSPECTION. Two credits. Second semester. Time to be arranged. Professor ROBERTS, Assistant Professors DANIELS and COREY.

Ten days in the second semester. An excursion by the senior class to a mine or mining district.

158. MINING LAW. One credit. Second semester. Two lectures for one-half semester.

A series of lectures on the mining laws of the United States and Alaska. Illustrated by diagrams and mine maps.

171. MINE GASES AND VENTILATION. Two credits. First semester. Two lectures. Prerequisite, Mining 122. Assistant Professor DANIELS.

Composition and properties of mine gases, methods of testing. Lighting of mines. Principles of ventilation; ventilating machinery.

172. MINING PLANT. Three credits. First semester. Three drafting periods. Prerequisite, Mining 122 and 171. Assistant Professor DANIELS.

Design of plant and machinery employed in mining and preparing coal for market.

174. COAL MINING MACHINERY. Two credits. Second semester. Two lectures. Prerequisite, senior standing. Assistant Professor DANIELS.

Study of coal cutting machines, mine locomotives, fans, hoists, pumps, and tippie or breaker machinery with especial reference to application to coal mining.

176. COAL WASHING. Four credits. Second semester. Two lectures and two laboratory periods. Prerequisite, Mining 101. Deposit, \$5.00. Assistant Professor DANIELS.

A detailed study of methods of preparing coal for market, together with laboratory tests and runs on various coal to determine best methods of preparation.

182. MINE MANAGEMENT. Two credits. Second semester. Prerequisite, senior standing. Assistant Professor DANIELS.

A study of the organization and administration of engineering plants, involving the keeping and interpretation of cost accounts, the efficiency of labor and methods, the financial, legal and social aspects of engineering operation.

184. INDUSTRIAL ORGANIZATION. Two credits. Second semester. Two lectures. Assistant Professor DANIELS.

A study of the principles of industrial organization and scientific management, involving the consideration of handling labor and materials, methods of operation, cost keeping and performance records, interpretation of efficiency data.

301. MINING METHODS. Three credits. First semester. Senior or graduate. Professor ROBERTS.

Two lectures and one laboratory period. A detailed study of certain branches of mining.

II. METALLURGY.

101. FIRE ASSAYING. Four credits. First semester. Prerequisite, Chemistry 101. Deposit, \$15.00. Assistant Professor COREY, Mr. GLENN and Mr. WHITTIER.

One lecture and three laboratory periods. The testing of reagents, the crushing, sampling and assaying of ores, furnace and mill products for lead, silver, gold and tin; also, the assay of base and gold bullion.

102. GENERAL METALLURGY. Four credits. Second semester. Deposit, \$10.00. Three lectures and one laboratory period. Professor ROBERTS, Assistant Professor COREY, and Mr. McELVENNY.

The properties of metals and alloys, fuels, refractory materials, furnaces and the extraction of the common metals from their ores. Visits to smelter.

103. METALLURGICAL FUELS. Two credits. First semester. Deposit, \$5.00. Assistant Professor DANIELS.

One lecture and one laboratory period. The composition, manufacture and metallurgical uses of natural and prepared fuels; the methods and costs of coking, gas making, and coal briquetting. Furnace and calorimeter tests of various types of fuels.

104. COPPER AND LEAD. Two credits. Second semester. Assistant Professor COREY.

Two lectures. The metallurgy of copper and lead, especially the methods of roasting, smelting and refining.

106. REFRACTORIES. Two credits. Second semester. One lecture and one laboratory period. Deposit, \$3.00. Assistant Professor COREY.

Methods of testing clays, refractory materials, cement-making materials.

151. GOLD AND SILVER. Three credits. First semester. Deposit, \$5.00. Two lectures and one laboratory period. Assistant Professor COREY.

Amalgamation, cyaniding, and chlorination of gold and silver ores. Complete tests checked by assays.

153. WET ASSAYING. Two credits. First semester. Two laboratory periods. Prerequisite, Chemistry 101. Deposit, \$10.00. Assistant Professor COREY.

Technical methods for the determination of copper, lead, zinc, etc., in ores and furnace products, etc.

155. IRON AND STEEL. Two credits. First semester. Two lectures. Assistant Professor DANIELS.

The metallurgy and manufacture of commercial iron and steel, with especial reference to their properties and uses in engineering work.

157. DESIGN OF PLANT. Three credits. Either semester. Three drafting periods. Senior or graduate. Professor ROBERTS and Assistant Professor DANIELS.

The designing of a piece of equipment or a structure for mining, milling or metallurgical purposes.

158. MINOR METALS. Two credits. Second semester. Two lectures. Assistant Professor COREY.

The metallurgy of zinc, antimony, tin, aluminum, nickel, etc.; a study of the plant required, the methods and costs of treatment.

160. METALLURGICAL ANALYSIS. Three credits. Second semester. One lecture. Two laboratory periods. Prerequisite, Chemistry 101. Deposit, \$10.00. Assistant Professor COREY.

Technical methods of analysis of slags and industrial products.

162. METALLOGRAPHY. One credit. Second semester. One lecture. Assistant Professors DANIELS and COREY.

The constitution and microstructure of metals and alloys, especially iron and steel. The preparation and study of metal sections, photomicrography and the use of the microscope to aid in testing industrial alloys.

163. METALLOGRAPHY. One credit. First semester. One laboratory period. Deposit, \$3.00. Prerequisite, Metallurgy 162. Assistant Professors DANIELS and COREY.

Advanced study of industrial alloys.

164. PYROMETRY AND ALLOYS. Two credits. Second semester. One lecture and one laboratory period. Deposit, \$3.00. Assistant Professor COREY.

Methods of measuring high temperatures. Union of metals by fusion, compression and electro-deposition; the behavior of metals and alloys under heat. Laboratory practice in thermal measurements, synthesis and testing of alloys.

165. METALLURGICAL PROBLEMS. One credit. First semester. Prerequisite, Chemistry 101, and Metallurgy 102. Assistant Professor COREY.

Physical chemistry for the metallurgist, slag calculations, etc., illustrated by figures quoted from the present practice at a number of smelting plants.

THESIS. See Mining 153 and 154.

SUMMER FIELD WORK. See Mining 106 and 156.

SUBJECTS PRESENTED BY DEPARTMENTS OF OTHER COLLEGES OF THE UNIVERSITY

CHEMISTRY

(Bagley Hall)

1. GENERAL CHEMISTRY. Four credits. Either semester. Two lectures and six laboratory hours per week. Professor BYERS, Assistant Professor ROSE, Instructors and Assistants.

This course is designed to meet the needs of students who come from accredited schools in which chemistry is not required.

2. GENERAL CHEMISTRY. Four credits. Either semester. A continuation of 1.

3. GENERAL CHEMISTRY. Four credits. From January 1st to April 1st. Three lectures and four laboratory hours per week. Professor BENSON.

This course is open to students who enter the University short courses, and does not demand any previous knowledge of chemistry.

21. GENERAL CHEMISTRY. Four credits. Either semester. Two lectures and six laboratory hours per week. This course is open to students who have had a year of chemistry in an accredited high school. Professor BYERS, Dr. TRUMBULL, Dr. LANGDON, and Assistants.

22. GENERAL CHEMISTRY. Four credits. Either semester. A continuation of 21. Professor BYERS, Dr. TRUMBULL, Dr. LANGDON, and Assistants.

The laboratory work is an elementary course in qualitative analysis.

101. QUANTITATIVE ANALYSIS. Four credits. Either semester. Twelve laboratory hours and 1 recitation per week. Dr. BELL.

The technique of gravimetric and volumetric analysis.

102. QUANTITATIVE ANALYSIS. Four credits. Either semester. A continuation of 101. Dr. BELL.

Mineral analysis and special and analytical processes.

CIVIL ENGINEERING

(Engineering Building)

1. ENGINEERING DRAWING. Two credits. Either semester. All freshman engineers. Prerequisite, plane geometry. Two three-hour laboratory periods. Assistant Professor WARNER, Mr. MAY, Mr. STRANDBERG, Mr. DUCKERING, Mr. RUBEY.

The use of instruments, freehand lettering, tracing.

6. ENGINEERING DRAWING. Four credits. Either semester. All freshman engineers. Prerequisite, solid geometry, drawing 1. Two recitations and two three-hour laboratory periods. Assistant Professor WARNER, Associate Professor HARRIS, Mr. STRANDBERG, Mr. RUBEY.

The elements of descriptive geometry, including the principles of shades, shadows and perspective. Practical problems.

11. ENGINEERING DRAWING. Two credits. Either semester. All sophomore engineers. Prerequisite, 6. Two three-hour laboratory periods. Assistant Professor WARNER.

Continuation of drawing 6. Problems and tracings.

20. ELEMENTARY PLANE SURVEYING. Four credits. Either semester. All freshman engineers. Prerequisite, Math. 51 and C. E. 1. Laboratory deposit, \$3.00. Two recitations and two three-hour laboratory periods. Assistant Professor MILLER, Mr. DUCKERING, Mr. RUBEY.

Adjustment of instruments, trigonometric computations, mapping of simple surveys, and a brief introduction to the United States system of public land surveying.

27. MINE SURVEYING. Three credits. First semester. Sophomore mining engineers. Prerequisite, C. E. 20. Laboratory deposit, \$3.00. Assistant Professor NEWTON.

Surface and underground practice. Observation for meridian. Topography. Mining claim surveys. Plane triangulation. Tunnel and vertical shaft work and connections. Mapping.

A trip of one or two days to a mine in the vicinity for the purpose of practice under operating conditions.

*103. SURVEYING CAMP. Six credits. Six weeks following the second semester sophomore work. Class will start for camp immediately following the commencement in June. Required of all C. E. students, beginning with the summer of 1916. Prerequisites, C. E. 14 and 22. Assistant Professor MILLER and ———.

Railway and topographic surveying. Elementary triangulation and the use of the plane table and stadia. Precise measurement of short base lines with the steel tape. Railway preliminary and location surveys. Cross sectioning and referencing the line and making the necessary right-of-way surveys.

107. TOPOGRAPHY. Four credits. First semester. Junior foresters and miners. Prerequisite, C. E. 55-56. Laboratory deposit, \$3.00. Assistant Professor NEWTON.

Topographic surveys as applied to forestry and mining. Reconnaissance and sketch maps, and exercises in reading and adjusting triangulation systems. Filling in topographic details with plane table and transit. Beginning of elementary railroad surveying.

* See bulletin of information—Summer School of Surveying.

131-132. MECHANICS. Four credits first semester. Three credits second semester. Junior engineers. Prerequisite, Mathematics 62, Physics 97; 131 is repeated second semester. Professor MORE, Mr. MAY, Mr. DUCKERING, Mr. STRANDBERG.

Statics, dynamics and mechanics of materials.

143. HYDRAULICS. Four credits. First semester. Senior miners and chemical engineers. Prerequisite, C. E. 131. Associate Professor HARRIS.

Elements of hydraulics with application to industrial uses.

144. HYDRAULIC MINING. (Short session in Mining, Jan.-Mar.). Professor ALLISON.

A course of two lectures per week on theory and practice of hydraulic mining.

ELECTRICAL ENGINEERING

(Engineering Building)

105. ELECTRICAL ENGINEERING. Four credits. Either semester. Junior C. E. and Ch. E. Prerequisite, Mathematics 62, Physics 96, 98. Assistant Professor KIRSTEN, Mr. CUSTIS and Mr. BURBANK.

A short course giving the fundamental principles of direct currents with experimental tests on commercial dynamos and motors.

ENGLISH

(Denny Hall)

3-4. FRESHMAN COMPOSITION. Two credits per semester. First semester of freshman and second semester of sophomore year. Associate Professor MILLIMAN in charge.

An adaptation of 1-2 for students in the College of Engineering. No students will be excused from the course, but a section will be provided for those whose training has been exceptionally good.

GEOLOGY.

(Science Hall)

3. GEOLOGY FOR ENGINEERING AND MINING STUDENTS. Four credits. Either semester. Three class periods and one laboratory period. Laboratory fee, \$1.00. Assistant Professor CULVER.

General geological principles with their special application to engineering and mining problems.

22. MINERALOGY. Four credits. Second semester. Two lectures and two laboratory periods. For engineering and mining students. Laboratory fee, \$2.00. Prerequisite, one year of college chemistry. Assistant Professor CULVER.

A descriptive and determinative study of the minerals, with blowpipe analysis.

121. PETROLOGY. Three credits. First semester. A special course for coal mining men in the College of Mines. Laboratory deposit, \$2.00. Prerequisite, Geology 3 and 22. Assistant Professor WEAVER or CULVER.

123. OPTICAL CRYSTALLOGRAPHY. Four credits. First semester. Two lectures and two laboratory periods. Prerequisite, Geology 1-2, or 3, or 12, college physics and college chemistry. Laboratory fee, \$2.00. Assistant Professor WEAVER.

Practice in the microscopic determination of crystals and artificial products by optical methods.

124. PETROGRAPHY. Four credits. Second semester. Two lectures and two laboratory periods. Prerequisite, Geology 22 and 123. Laboratory fee, \$2.00. Assistant Professor WEAVER.

A study of the distinguishing characteristics of the different groups and species of rocks, with practice in their determination by modern petrographical methods.

125-126. FIELD WORK FOR MINING STUDENTS. Credits to be arranged up to three. One credit for eight field days with written report. Prerequisite, 2 or 3 and 21 or 22 (124 also preferred). Assistant Professor WEAVER.

127-128. ECONOMIC GEOLOGY. Three credits per semester. For mining students four credits second semester. Three lectures and discussion of papers. Prerequisite, for 128, Geology 3, 22, 124. Professor LANDES.

A study of the origin and extent of economic deposits of non-metals (first semester), metals (second semester). Their production and use.

131. PALEONTOLOGY. Four credits. First semester. Three lectures and one laboratory period. Prerequisite, 2 or 3. Assistant Professor WEAVER.

A laboratory study of fossil invertebrates with their geologic and geographic distribution.

Short Course 2. MINERALOGY. Instruction and practice in blow-pipe analysis, with lectures upon the common minerals, and practice in the identification of minerals by field tests. Twice a week. Deposit, \$2.00. Assistant Professor CULVER.

Short Course 3. ELEMENTS OF GEOLOGY. Lectures on the elements of geology, the common varieties of rock, metalliferous veins and ore deposits, etc. Twice a week. Assistant Professor CULVER.

MATHEMATICS

(Science Hall)

1-2. SOLID GEOMETRY. Two credits per semester. Prerequisite, plane geometry.

Required during the freshman year of all students in the colleges of Engineering, Forestry and Mines who do not offer solid geometry for admission.

4. SOLID GEOMETRY. Three credits. Second semester. Same as 1-2.

51. TRIGONOMETRY AND ALGEBRA. Four credits. First semester. Prerequisite, same as 11-12.

Primarily for students in the colleges of Engineering, Forestry, and Mines. The elements of plane trigonometry and supplementary work in algebra equivalent to one hour per week.

52. ANALYTICAL GEOMETRY AND ALGEBRA. Four credits. Either semester. Prerequisite, 51.

Primarily for students in the colleges of Engineering, Forestry, and Mines. The elements of analytical geometry and supplemental work in algebra equivalent to one hour per week.

61. CALCULUS FOR ENGINEERS. Four credits. Either semester. Prerequisite, 52.

62. CALCULUS FOR ENGINEERS. Four credits. Either semester. Continuation of 61.

151. APPLICATION OF THE CALCULUS FOR ENGINEERS. Two credits. Either semester. Prerequisite, 62.

MECHANICAL ENGINEERING

(Engineering Building)

1. CARPENTRY AND WOOD-TURNING. Two credits. Either semester. Mr. BEATTIE.

4. MINE TIMBER FRAMING. Two credits. Second semester. Freshman mining engineers. Mr. BEATTIE and Assistant Professor DANIELS.

53. FORGE AND FOUNDRY. Two credits. Either semester. Mr. KANE.

54. MACHINE WORK. Two credits. Either semester. Mr. KANE.

82. STEAM ENGINEERING. Two credits. Either semester. Professor EASTWOOD.

The various forms of steam apparatus used in modern power plants, considering the construction, use and reason for installing such apparatus.

140. EXPERIMENTAL ENGINEERING. Two credits. Either semester. Prerequisite, preceded or accompanied by M. E. 82. Associate Professor WILSON.

Calibrations of thermometers, gages, indicator springs, etc. Friction and mechanical efficiency tests of the simple steam engine. One complete engine and boiler test with report.

MILITARY SCIENCE AND TACTICS

(The Armory)

WILLIAM TAYLOR PATTEN, CAPTAIN, U. S. A., RETIRED, COMMANDANT

A course of two years in military training is required. All able-bodied male students (except those from foreign countries, not intending to become naturalized) must take the course, which by regulations of the University is required during the first and second years. Three hours a week are devoted to military training, for which two credits are given each semester.

MODERN LANGUAGE

Twelve hours in a modern foreign language are required in Curriculum V in Mining Engineering. For description of courses in modern languages, see bulletin of the College of Liberal Arts.

PHYSICS

(Denny Hall)

95. PHYSICS MEASUREMENTS. Two credits. Either semester. All sophomore engineers. One four-hour laboratory period. Laboratory deposit, \$6.00 per year. Mr. GILBREATH.

96. PHYSICS MEASUREMENTS. One credit. Either semester. Sophomore engineers. One three-hour laboratory period. Laboratory deposit, \$6.00 per year. Mr. GILBREATH.

97. MECHANICS, WAVE MOTION AND LIGHT. Four credits. Either semester. Prerequisite, 8 credits in mathematics. All sophomore engineers. Assistant Professors BRAKEL and ANDERSON.

This course must be accompanied by 95.

98. ELECTRICITY AND HEAT. Four credits. Either semester. Sophomore engineers. Prerequisite, 97. Assistant Professors BRAKEL and ANDERSON.

This course must be accompanied by 96.

POLITICAL AND SOCIAL SCIENCE

(Denny Hall)

3. ELEMENTS OF ECONOMICS. Three credits. Either semester. Dr. JANES, Mr. LAUBE, Mr. AKERMAN, and Mr. MACAULAY.

The Bulletin of the University of Washington
includes the following publications:

ENTRANCE INFORMATION
THE CATALOGUE
BULLETINS OF
COLLEGE OF LIBERAL ARTS
COLLEGE OF SCIENCE
COLLEGE OF EDUCATION
COLLEGE OF ENGINEERING
COLLEGE OF FINE ARTS
COLLEGE OF FORESTRY
SCHOOL OF LAW
COLLEGE OF MINES
COLLEGE OF PHARMACY
GRADUATE SCHOOL
EXTENSION DIVISION
SUMMER SESSION
PUGET SOUND MARINE STATION

Requests for bulletins, or for general information in regard to the University, and all credentials and correspondence relative to admission or advanced standing should be addressed to THE RECORDER, University of Washington, Seattle, Washington.

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BULLETIN

UNIVERSITY OF WASHINGTON

Series I

APRIL, 1918

No. 119—PART 7

College of Mines 1918-1919

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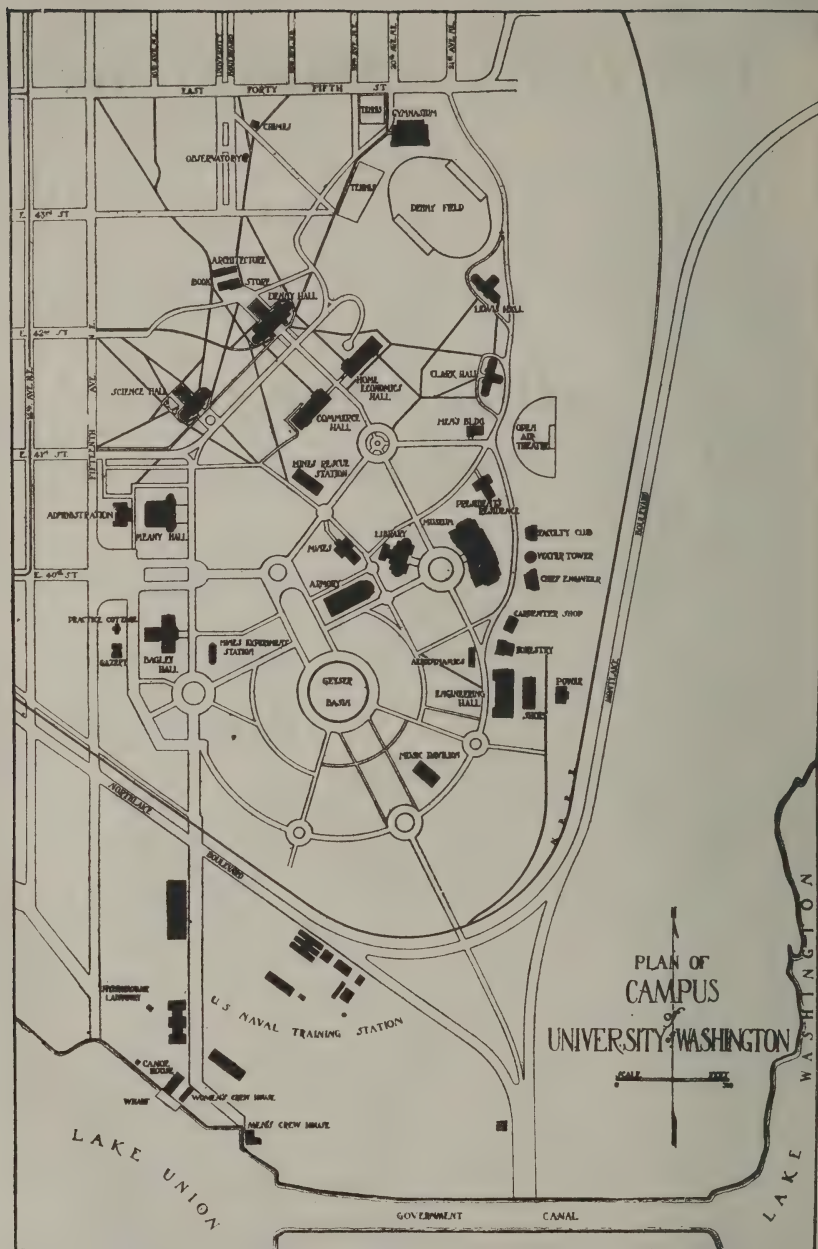
MAR 4 1929

UNIVERSITY OF ILLINOIS



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Seattle

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MAR 4 1929

University Calendar
1918-1919

FIRST QUARTER

Examinations for admission and for exemption from College English, Thursday, Friday and Saturday, September 26, 27 and 28, at 9 a. m. and 2 p. m.
Registration of new first year students.....Friday and Saturday, September 27 and 28
Registration of all other students.....Monday and Tuesday, September 30 and October 1
Instruction begins.....Wednesday, October 2
President's annual address.....Friday, October 4, 10 a. m.
Women's assemblyFriday, October 11, 11 a. m.
Thanksgiving RecessWednesday, November 27, 6 p. m., to Monday, December 2, 8 a. m.
Quarter examinationsTuesday, Wednesday, Thursday and Friday, December 17, 18, 19 and 20

SECOND QUARTER

Winter Mining Session begins.....Thursday, January 2
Registration days.....Thursday and Friday, January 2 and 3
Instruction begins.....Monday, January 6
Washington's birthday (holiday).....Saturday, February 22
Quarter examinationsFriday, Saturday, Monday and Tuesday, March 21, 22, 24 and 25

THIRD QUARTER

Registration days.....Monday and Tuesday, March 31 and April 1
Instruction beginsWednesday, April 2
Campus dayFriday, April 25
Junior day.....Saturday, May 24
Memorial day (holiday).....Friday, May 30
Quarter examinationsTuesday, Wednesday, Thursday and Friday, June 10, 11, 12 and 13
Class day and President's reception.....Saturday, June 14
Baccalaureate SundayJune 15
Commencement and alumni day.....Monday, June 16

FOURTH QUARTER

Registration for first term.....Tuesday, June 17
Instruction beginsWednesday, June 18
Term examinationsWednesday, July 23
Registration for second term.....Friday, July 25
Term examinations.....Saturday, August 30

The Board of Regents

WILLIAM T. PERKINS, President.....	Seattle
Term ends March, 1920	
WINLOCK W. MILLER.....	Seattle
Term ends March, 1920	
ELDRIDGE WHEELER	Montesano
Term ends March, 1921	
OSCAR A. FECHTER.....	Yakima
Term ends March, 1922	
JOHN A. REA.....	Tacoma
Term ends March, 1922	
WILLIAM A. SHANNON.....	Seattle
Term ends March, 1923	
RUTH KARR McKEE.....	Olympia
Term ends March, 1923	

WILLIAM MARKHAM, Secretary to the Board

Officers of Administration

THE UNIVERSITY

HENRY SUZZALLO, Ph. D., LL.D.....	President of the University Administration Hall
JOHN THOMAS CONDON, LL.M.....	Dean of Faculties Administration Hall
HERBERT THOMAS CONDON, LL. B.....	Comptroller Administration Hall
EDWARD NOBLE STONE, A. M.....	Registrar Administration Hall
EDWIN BICKNELL STEVENS, A. M.....	Executive Secretary Administration Hall
' ARTHUR RAGAN PRIEST, A. M.....	Dean of Men Administration Hall
MACY MILLMORE SKINNER, Ph. D.....	Assistant Dean of Men Administration Hall
ETHEL HUNLEY COLDWELL, A. M.....	Dean of Women Administration Hall
WILLIAM ELMER HENRY, A. M.....	Librarian Library
EVERETT OWEN EASTWOOD, C. E.....	Consulting Engineer Engineering Hall
' DAVID CONNOLLY HALL, M. D.....	University Health Officer
FRANK STEVENS HALL.....	Director of Museum Museum

THE COLLEGES AND SCHOOLS

DAVID THOMSON, B. A.....	Dean of the College of Liberal Arts Denny Hall
CARL EDWARD MAGNUSSON, Ph. D.....	Acting Dean of the College of Engineering Engineering Hall
MILNOR ROBERTS, A. B.....	Dean of the College of Mines Mines Hall
CHARLES WILLIS JOHNSON, Ph. C., Ph. D....	Dean of the College of Pharmacy Bagley Hall
JOHN THOMAS CONDON, LL. M.....	Dean of the School of Law Commerce Hall
HUGO WINKENWERDER, M. F.....	Dean of the College of Forestry Forestry Hall
J. ALLEN SMITH, Ph. D.....	Dean of the Graduate School Denny Hall
HENRY LANDES, A. M.....	Dean of the College of Science Science Hall
FREDERICK ELMER BOLTON, Ph. D.....	Dean of the College of Education Home Economics Hall
IRVING MACKEY GLEN, A. M.....	Dean of the College of Fine Arts Meany Hall
WILLIAM ELMER HENRY, A. M.....	Director of the Library School Library
' CARLETON HUBBELL PARKER, Ph. D.....	Dean of the College of Business Administration Commerce Hall
' COLIN VICTOR DYMENT, B. A.....	Director of the School of Journalism Commerce Hall
STEPHEN IVAN MILLER, LL. B., A. B.....	Acting Director of the College of Business Administration Commerce Hall
WILLIAM TAYLOR PATTEN, Captain U. S. A., Retired.....	Acting Director of the College of Naval, Military and Aeronautical Science Armory

THE EXTENSION DIVISION

EDWIN AUGUSTUS START, A. M.....	Director Administration Hall
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¹ Absent on War Service

[†] Died, March 17, 1918

College of Mines

THE FACULTY

HENRY SUZZALLO, PH. D. (Columbia), LL. D. (California), PRESIDENT.

JOHN THOMAS CONDON, LL. M. (Northwestern), DEAN OF FACULTIES.

MILNOR ROBERTS, A. B. (Stanford), Professor of Mining Engineering and Metallurgy; DEAN.

JOSEPH DANIELS, S. B. (Massachusetts Institute of Technology), M. S. (Lehigh), Associate Professor of Mining Engineering and Metallurgy.

CLARENCE RAYMOND COREY, E. M. (Montana State School of Mines), A. M. (Columbia), Assistant Professor of Mining Engineering and Metallurgy.

—————, Instructor in Ceramics.

HARVEY L. GLENN, B. S. (Iowa State College), Lecturer on Assaying of Bullion.

GUY M. KERR, PH. D. (Goettingen), Lecturer on Copper Smelting.

FREDERICK POWELL, E. M. (Columbia), Lecturer on Gold Dredging.

K. H. CHISHOLM, Foreman in charge of Mines Rescue Training, U. S. Bureau of Mines, Northwest Station.

BYRON M. BIRD, Assistant in Metallurgy.

JOHN H. THOMPSON, Assistant in Mining.

ALBERT E. SLACK, Assistant in Stock Room.

RAY HOLBROOK, Mechanic in charge of Equipment.

JOHN THOMAS CONDON, LL. M. (Northwestern), Professor of Law.

¹HORACE G. BYERS, PH. D. (Johns Hopkins), Professor of Chemistry.

TREVOR KINCAID, A. M. (Washington), Professor of Zoology.

FREDERICK ARTHUR OSBORN, PH. D. (Michigan), Professor of Physics.

²ROBERT EDOUARD MORITZ, PH. D. (Nebraska), PH. N. D. (Strassburg), Professor of Mathematics.

CARL EDWARD MAGNUSSON, E. E. (Minnesota), PH. D. (Wisconsin), Professor of Electrical Engineering.

EVERETT OWEN EASTWOOD, C. E., A. M. (Virginia), S. B. (Massachusetts Institute of Technology), Professor of Mechanical Engineering.

³DAVID CONNOLLY HALL, SC. M., M. D. (Chicago), Director of Physical Education for Men.

¹CHARLES CHURCH MORE, M. S., C. E. (Lafayette), M. C. E. (Cornell), Professor of Civil Engineering.

HENRY KREITZER BENSON, PH. D. (Columbia), Professor of Industrial Chemistry.

¹WILLIAM FRANKLIN ALLISON, C. E. (Cornell), Professor of Municipal and Highway Engineering.

WILLIAM TAYLOR PATTEN, Captain U. S. A., Retired, Professor of Military Science and Tactics.

LOREN DOUGLAS MILLIMAN, A. B. (Michigan), Associate Professor of English.

CHARLES WILLIAM HARRIS, C. E. (Cornell), Associate Professor of Civil Engineering.

VANDERVEER CUSTIS, PH. D. (Harvard), Associate Professor of Economics.

GEORGE SAMUEL WILSON, B. S. (Nebraska), Associate Professor of Mechanical Engineering.

²EDGAR ALLEN LOEW, B. S., E. E. (Wisconsin), Associate Professor of Electrical Engineering.

HENRY LOUIS BRAKEL, PH. D. (Cornell), Assistant Professor of Physics.

GEORGE IRVING GAVETT, B. S., C. E. (Michigan), Assistant Professor of Mathematics.

CHARLES EDWIN WEAVER, PH. D. (California), Assistant Professor of Geology.

ALLEN FULLER CARPENTER, PH. D. (Chicago), Assistant Professor of Mathematics.

¹JOHN WILLIAM MILLER, B. S., C. E. (Nebraska), Assistant Professor of Civil Engineering.

¹ Absent on war service.

² Absent on leave, 1918-1919.

³ Absent on leave, second and third quarter, 1918.

- HAROLD EUGENE CULVER, PH. M. (Wisconsin), Assistant Professor of Geology.
FRANK MELVILLE WARNER, B. S. (M. E.), (Wisconsin), Assistant Professor of Engineering Drawing.
FRED HARVEY HEATH, PH. D. (Yale), Assistant Professor of Chemistry.
SETH CHAPIN LANGDON, PH. D. (Washington), Instructor in Chemistry.
CHAUNCEY WERNECKE, B. S. (C. E.) (Washington), Instructor in Civil Engineering.
SAMUEL THOMAS BEATTIE, Instructor in Woodwork.
SANDY MORROW KANE, Instructor in Metal Work.
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ADVISORY BOARD COLLEGE OF MINES

UNIVERSITY OF WASHINGTON

- ROY H. CLABKE, mining engineer, Peyton Building, Spokane.
JOHN ERIKSON, mine operator, Erikson Building, Seattle.
J. T. HEFFERNAN, president of the Heffernan Engine Works, mine operator, 108 Railroad Avenue South, Seattle.
E. C. HUGHES, of Hughes, McMicken, Dovell & Ramsey, attorneys, mining lawyer, Colman Building, Seattle.
CHARLES HUSSEY, general manager of estate of John A. Finch, mine operator, Empire State Building, Spokane.
W. R. RUST, founder of the Tacoma Smelter, president of Tacoma Exploration Company, Box 1454, Tacoma.
NATHANIEL D. MOORE, general manager of the Pacific Coast Coal Co., Seattle.

*ADMISSION TO FRESHMAN STANDING

A student must offer for admission to freshman standing in the University, fifteen units† by examination or by certificate from an accredited school from which he has graduated. The fifteen units must include the following combinations:

3 units of English.

2 units of mathematics (1 unit of algebra, 1 unit of plane geometry).

3 units selected from one of the following groups (or 2 units, if 3 units of mathematics are presented):

(a) Latin and Greek (not less than 2 units of Latin, or 1 of Greek counted).

(b) Modern foreign language (at least 2 units in *one* language; not less than one unit counted in *any* language).

(c) History, civics, economics (at least one unit to form a year of consecutive work in history).

(d) Physics, chemistry, botany, zoology, general biology, physical geography, geology, physiology. (Not less than one unit counted in physics, chemistry, or general biology. No science counted as applying on this requirement unless it includes a satisfactory amount of laboratory work.)

2 units in subjects represented in the above groups (a)-(d).

5 units selected from any subjects accepted by an approved high school for its diploma; not more than 4 units, however, may be in vocational subjects.

In addition to the three units of English and the two units of mathematics required for admission to all colleges of the University it is recommended that a student expecting to enter the College of Mines should elect his work from the groups (a) to (d), so as to offer the following subjects:

Advanced algebra	1½ unit
Solid geometry	1½ unit
Physics	1 unit

If he shall not have included these subjects in his high school elections, it will be necessary for him to include them among his elections in college.

DEGREES

The four-year curricula in the College of Mines lead to the following degrees: Curriculum I, bachelor of science in mining engineering, B. S. (Min. E.); curriculum II, bachelor of science in geology and mining, B. S. (Geol. and Min.); curriculum III, bachelor of science in metallurgical engineering, B. S. (Met. E.); curriculum IV, bachelor of science in coal mining engineering, B. S. (Coal Mine E.) A new group of electro-metallurgical subjects is offered in curriculum V.

The degree of engineer of mines (E. M.) is given to graduates in mining engineering who have practiced their profession for at least three years, and who present a satisfactory thesis. Graduates in metallurgy may

* More detailed information concerning admission is furnished in a separate section of the University Bulletin, known as Entrance Information. (Pages 7-11)

† To count as a "unit" a subject must be taught five times a week, in periods of not less than forty-five minutes, for a school year of not less than thirty-six weeks.

receive the degree of metallurgical engineer (Met. E.) under similar conditions.

MINING AND METALLURGICAL RESEARCH

The purpose of the department is to stimulate and encourage development in the mining and metallurgical industry of Washington, the Pacific Northwest and Alaska by research in the special problems presented, and to solve the problems through the efforts of fellowship holders and others studying in the department.

Graduates from suitable technical courses at institutions of recognized standing, or men who present evidence of technical training which has fitted them to undertake investigations, are eligible to enroll in mining and metallurgical research. The degree of master of science may be granted to those students who, holding a suitable bachelor of science degree, complete investigative work in compliance with the University requirements for the master's degree. Although as much latitude as possible will be allowed in the choice of subjects for research, the general topics will be those which are of special importance to this region.

RESEARCH FELLOWSHIPS

In connection with the department, five research fellowships of \$720 annual value have been established. These fellowships are open to qualified graduates of scientific or technical courses in institutions of recognized standing. Applicants should send a copy of their record from the registrar's office of the college where they have been, or will be, graduated, and the names and addresses of at least three references who know their character, training, and ability. Applications for these fellowships are due not later than May 15th, and should be addressed to the Dean, College of Mines, Seattle, Washington.

Appointees to the fellowships report for duty on July 1, and are required to be on duty during the entire year, except that in case of reappointment for a second year, the fellowship holder is given a vacation from June 15 to July 1.

Fellowship holders are required to register as graduate students in the University of Washington and to become candidates for the degree of master of science in mining engineering, or metallurgy, unless an equivalent degree has been previously earned.

INVESTIGATIONS OF PROBLEMS

The University will, under certain conditions, permit mining and metallurgical companies who have special problems for solution, to detail a representative to work on such problems, or to meet the expense of engaging a man to do so. Experiments which can be carried on as readily in commercial laboratories and which do not require direction from the Bureau's experts are not undertaken. The research work shall be under the direction of the department, and complete records of all the data obtained in the investigation of the problems shall be filed with the department, which shall have the right to publish this information for the benefit of the mining and metallurgical industry.

MINING AND METALLURGICAL EXPERIMENT STATION UNITED STATES BUREAU OF MINES

The United States Bureau of Mines maintains a mining and metallurgical experiment station for the Pacific Northwest and the coast regions of Alaska at the College of Mines. The headquarters of the station, from which all operations in this territory are directed, are in the Bureau of Mines building, between Mines and Bagley halls. An analytical laboratory is in the same building, while the electric furnaces and other equipment used by the Bureau in cooperation with the College are housed in the Mines building. At present the principal investigations being conducted by the station are in electro-metallurgy, and in the mining, treatment and uses of coal. Members of the experiment station staff give occasional lectures to the students of the University on subjects dealing with their special lines of work.

UNITED STATES MINES RESCUE TRAINING STATION

The United States Mines Rescue Training Station, operated in connection with the College of Mines, occupies a separate building. The "smokeroom" is the largest of its kind in the country, measuring 25 by 50 feet.

Several sets of various types of oxygen rescue and resuscitation apparatus are kept on hand for practice as well as for use in mine rescue work. The purpose of the station is to train miners in the use of oxygen helmets, which are used in cases of mine fires and explosions in both coal and metal mines. From ten days to two weeks' time is required for the course of training. The applicant is taught the construction of the apparatus and is required to wear it for four hours each day, in two periods of two hours each. The practice is carried on in a room filled with gas which cannot be breathed without immediate danger, and the work to be performed is the same as that which would be required in actual mining operations or rescue work. The smokeroom represents a portion of a mine, and is equipped with mine car, track, overcast, timbers and brick. First-aid instruction is also given. Applicants who have completed the course of training receive a certificate from the U. S. Bureau of Mines.

A one-ton, forty-five horse-power automobile truck, equipped with rescue apparatus ready for any emergency calls, forms part of the equipment of the rescue station.

INSTRUCTION FOR COAL MINING MEN

Miners taking the rescue training also receive instruction in the College of Mines on the subjects of mine gases, explosions and the origin and distribution of Pacific Coast and Alaska coals. Laboratory experiments are carried on to show the methods of analyzing coals and determining the uses to which they may be put. The methods of testing for permissible explosives at the Pittsburg station and the safe methods of charging, tamping and firing are explained.

MINING AND METALLURGICAL INDUSTRIES AVAILABLE FOR STUDY

Excellent opportunities for becoming familiar with mining and metallurgical operations are open to students in the College of Mines. Mining machinery of the best type is in operation within easy reach of the University. Much of the heavy mining machinery used in the neighboring states and Alaska is built in the city of Seattle, while patented machines, such as drills and concentrating tables of all makes, are kept in stock and as working exhibits by the firms that supply the North Pacific coast regions. More than 40 eastern firms dealing in mining equipment make their Seattle branches the distributing center for the Pacific Northwest, British Columbia and Alaska. The application of hydraulic mining methods to city grading is being carried on locally on a very large scale and with the most approved pumping and piping appliances and methods. Equally important to the mining engineer are the operations of the steam shovels, which are used largely now in iron, copper and gold mining. The engineers in charge of these plants have given the mining students every opportunity to become familiar with the methods of planning and carrying on the work, and the same statement applies to the mine operators throughout the state.

A partial list of the other available works of interest includes coal mines and coke ovens, with the largest production west of the Rocky mountains; metal mines of gold, silver, copper, arsenic, antimony, iron, etc.; cement plants, glass works, several stone quarries and dressing works; clay mines, clay and pottery works; gravel and sand pits with large production and approved methods; a region of varied geology with many economic minerals; the Tacoma smelters and refineries; the U. S. assay office; the West Seattle steel plant of the Pacific Coast Steel Co., and several plants engaged in electro-metallurgical work.

MINING AND METALLURGICAL LABORATORIES

The laboratories of the College of Mines are housed in a two-story building of pressed brick. The main portion of the structure, measuring 50 by 60 feet, contains the offices, library, classrooms, drafting room and museum, as well as laboratories, desks, stockroom and balance room for assaying and general metallurgy. The rear wing, 40 by 66 feet, with tower, is occupied by mining and milling machinery, electric furnaces, and stocks of ore, coals and clays. An addition contains a steel locker room, shower-bath room and a metallographic laboratory.

The metallurgical equipment includes standard size furnaces fired by six methods — coal, coke, gasoline, gas, fuel-oil and electricity. Electric current to the amount of 200 kilowatts is available for extensive experiments in electric smelting. Other important pieces of equipment are a reverberatory furnace, pyrometers of several types, cyanide equipment, amalgamating devices, blowers, calorimeters, balances, sampling machines, and exhibits of metallurgical processes and products.

The mining equipment consists of an air compressor, receiver, three rock drills, aerial tram, loading and tamping models, hand tools, full equipment for practice in blasting, models, drawings, blueprints, photographs, lantern with 1,600 slides, and collection of ores and minerals. The College

of Mines mill contains breaks, rolls, 3-stamp battery, feeders, screens, classifiers, jigs, six concentrating tables, flotation cells of six types, Dings magnetic separator, coal washing equipment, and accessory apparatus.

MINING SOCIETY

The Mining Society, affiliated with the American Institute of Mining Engineers, has a membership composed of upperclassmen, graduate students and three sophomores, chosen for the excellence of their records in actual mining. At the monthly meetings of the society addresses are made by prominent mining engineers, and papers descriptive of their summer work are presented by the student members.

CURRICULA IN THE COLLEGE OF MINES

FRESHMAN YEAR FOR ALL CURRICULA

<i>First quarter</i>	<i>Credits</i>	<i>Second quarter</i>	<i>Credits</i>	<i>Third quarter</i>	<i>Credits</i>
Math. 51 (algebra).....	3	Min. 50 (timbering).....	1	Math. 53 (analytics).....	3
C. E. 11 (engr. problems)...	3	Math. 52 (trig.).....	3	C. E. 13 (engr. problems)...	3
Chem. 1 or 21 (general)....	5	C. E. 12 (engr. problems)...	3	Chem. 3 or 23 (general)....	5
C. E. 1 (drawing).....	3	Chem. 2 or 22 (general)....	5	C. E. 21 (surveying).....	3
M. E. 1 (shop).....	1	C. E. 2 (drawing).....	3	M. E. 4 (timber framing)....	1
Mil. Sci.	2	Mil. Sci.	2	Mil. Sci.	2
	17		17		17

* Summer camp in mining and topographical survey (four weeks) 6 credits.

SOPHOMORE YEAR FOR ALL CURRICULA

Min. 51 (elements).....	3	C. E. 27 (mine surv.).....	3	Geol. 22 (petrology).....	3
Geol. 5 (engr.).....	5	Geol. 121 (mineralogy)....	3	Physics 99 (engr.).....	5
Physics 97 (engr.).....	5	Physics 98 (engr.).....	5	Chem. 101 (quant.).....	4
Math. 61 (calculus).....	3	Math. 62 (calculus).....	3	Eng. 5-6 (engr. comp.)....	3
*Surveying Computations...	2	M. E. 53 (shop).....	1	Mil. Sci.	2
Mil. Sci.	2	Mil. Sci.	2		
	18		17		17

Mining practice in summer vacations.†

MINING ENGINEERING (OPTION I)

JUNIOR YEAR

<i>First quarter</i>	<i>Credits</i>	<i>Second quarter</i>	<i>Credits</i>	<i>Third quarter</i>	<i>Credits</i>
Min. 101 (milling).....	3	Min. 103 (rescue).....	1	Met. 102 (general).....	5
Met. 101 (fire assay).....	5	Min. 158 (law).....	2	E. E. 121-122 (A. C.).....	2
Geol. 123 (opt. miner)....	4	Geol. 124 (petrog.).....	4	C. E. 142 (hydraulics)....	6
C. E. 131 (mechanics).....	3	E. E. 102 (D. C.).....	5	Min. 106 (June excursion)...	3
		C. E. 132 (mechanics)....	3		
	15		15		19

SENIOR YEAR

Min. 151 (mining).....	5	Min. 154 (thesis).....	2	Min. 152 (ore dressing)...	5
Min. 153 (thesis).....	1	Met. 157 (design).....	3	Min. 155 (thesis).....	3
Met. 151 (gold-silver)....	3	Met. 162 (metalog.).....	2	Min. 182 (management)....	2
Met. 153 (wet assay).....	3	Geol. 128 (economic)....	3	Econ. 51 (introduction)....	5
Met. 155 (iron-steel)....	3	Elective	5		
	15		15		15

* Not offered in 1918-1919.

† Mining or metallurgical practice is required of all students during a summer vacation following the sophomore or junior year.

GEOLOGY AND MINING (OPTION II)

JUNIOR YEAR

<i>First quarter</i>	<i>Credits</i>	<i>Second quarter</i>	<i>Credits</i>	<i>Third quarter</i>	<i>Credits</i>
Min. 101 (milling).....	3	Min. 103 (rescue).....	1	Met. 102 (general).....	5
Met. 101 (fire assay).....	5	Min. 158 (law).....	2	Geol. 125 (adv. petrog.)...	2
Met. 103 (fuels).....	3	Geol. 124 (petrog.).....	4	Geol. (elective).....	3
Geol. 123 (opt. miner).....	4	Zool. 15 (evolution).....	3	Elective	5
		Zool. 16 (ethnology).....	2	Min. 106 (June excursion)...	3
		Elective	3		
	15		15		18

SENIOR YEAR

Min. 151 (mining).....	5	Min. 154 (thesis).....	2	Min. 152 (ore dressing)....	5
Min. 153 (thesis).....	1	Met. 162 (metalog.).....	2	Min. 155 (thesis).....	2
Met. 151 (gold-silver).....	3	Geol. 128 (economic).....	3	Geol. 132 (paleo.).....	3
Met. 153 (wet assay).....	3	Geol. 131 (paleo.).....	3	Econ. 51 (introduction)....	5
Geol. 127 (economic).....	3	Elective	5		
	15		15		16

METALLURGY (OPTION III)

JUNIOR YEAR

<i>First quarter</i>	<i>Credits</i>	<i>Second quarter</i>	<i>Credits</i>	<i>Third quarter</i>	<i>Credits</i>
Min. 101 (milling).....	3	Min. 103 (rescue).....	1	Met. 102 (general).....	5
Met. 101 (fire assay).....	5	Geol. 128 (economic).....	3	E. E. 121-122 (A. C.).....	5
Met. 103 (fuels).....	3	C. E. 132 (mechanics).....	3	Econ. 51 (introduction)....	5
C. E. 131 (mechanics).....	3	E. E. 101-102 (D. C.).....	5	Min. 106 (June excursion)...	3
M. E. 105 (mach. shop)...	1	M. E. 106 (mach. shop)...	1		
	15	Elective	2		
			15		18

SENIOR YEAR

Min. 151 (mining).....	5	Min. 154 (thesis).....	2	Min. 152 (ore dressing)....	5
Min. 153 (thesis).....	1	Met. 104 (copper-lead)....	3	Min. 155 (thesis).....	2
Met. 151 (gold-silver).....	3	Met. 157 (design).....	3	Met. 163 (metalog.).....	2
Met. 153 (wet assay).....	3	Met. 160 (analysis).....	3	C. E. 142 (hydraulics)....	6
Met. 155 (iron-steel).....	3	Met. 162 (metalog.).....	2		
	15	Met. 165 (calculations)...	2		
			15		15

COAL MINING (OPTION IV)

JUNIOR YEAR

<i>First quarter</i>	<i>Credits</i>	<i>Second quarter</i>	<i>Credits</i>	<i>Third quarter</i>	<i>Credits</i>
Min. 101 (milling).....	3	Min. 103 (rescue).....	1	Met. 102 (general).....	5
Met. 101 (fire assay).....	5	Min. 120 (coal resources)...	3	E. E. 121-122 (A. C.).....	5
Geol. 122 (coal mining)....	5	Min. 122 (coal mining)....	3	C. E. 142 (hydraulics)....	6
C. E. 131 (mechanics).....	3	E. E. 101-102 (D. C.).....	5	Min. 106 (June excursion)...	3
		C. E. 132 (mechanics).....	3		
	16		15		19

SENIOR YEAR

Min. 151 (mining).....	5	Min. 154 (thesis).....	2	Min. 155 (thesis).....	2
Min. 153 (thesis).....	1	Min. 171 (gases).....	3	Min. 172 (plant).....	3
Met. 155 (iron-steel).....	3	Min. 176 (washing).....	5	Min. 174 (mach.).....	3
M. E. 82 (steam eng.).....	3	Elective	5	Min. 182 (management)...	3
M. E. 140 (exp. eng.).....	3			Econ. 51 (introduction)....	5
	15		15		16

ELECTRO-METALLURGY (OPTION V)

JUNIOR YEAR

Same as Option III

SENIOR YEAR

<i>First quarter</i>	<i>Credits</i>	<i>Second quarter</i>	<i>Credits</i>	<i>Third quarter</i>	<i>Credits</i>
Min. 151 (mining).....	5	Min. 154 (thesis).....	2	Min. 152 (ore dressing)...	5
Min. 153 (thesis).....	1	Met. 104 (copper-lead)....	3	Min. 154 (thesis).....	2
Met. 151 (gold-silver).....	3	Met. 162 (metalog.).....	2	Met. 166 (electro).....	3
Met. 153 (wet assay).....	3	Met. 165 (calculations)....	2	Chem. 204 (electro).....	5
Met. 155 (iron-steel).....	3	C. E. 142 (hydraulics)....	6		
	<u>15</u>		<u>15</u>		<u>15</u>

CERAMIC ENGINEERING (OPTION VI)

Courses and curriculum to be announced at opening of first quarter, 1918.

DEPARTMENTS OF INSTRUCTION

The University reserves the right to withdraw temporarily any course which is not justified by the demand.

MINING ENGINEERING AND METALLURGY

Mines Hall

PROFESSOR ROBERTS, ASSOCIATE PROFESSOR DANIELS, ASSISTANT PROFESSOR COREY, INSTRUCTOR— LECTURERS: MR. POWELL, MR. GLENN, MR. KERR, MR. CHISHOLM. ASSISTANTS: MR. SLACK, MR. BIRD, MR. THOMPSON, MR. HOLBROOK.

Mining 20, 21, 50, 103 and Metallurgy 70, 71 and 155 are of immediate application to war or war industries.

I. MINING ENGINEERING

Ceramics courses and a four-year curriculum in ceramic engineering will be announced at the opening of the first quarter in October, 1918.

Coal miners who are taking the ten-day course in the U. S. Mine Rescue Training Station are given daily instruction and laboratory demonstrations in the subjects of mine gases, ventilation, the origin and composition of coals, and coal analysis.

*20.—MINING AND DEMOLITION.—Five credits per quarter. First and second quarters. Three recitations and two laboratories.

ROBERTS, DANIELS, HOLBROOK.

Lectures, recitations and laboratory practice in surface and underground excavation for military purposes, use of explosives for excavation and demolition, methods of timbering, pumping and drainage.

*21.—EXPLOSIVES.—Three credits per quarter. Third quarter. Three lectures.

DANIELS.

The manufacture, use, handling and storage of explosives used in mining, tunneling and ordnance work.

* War courses open to non-technical students.

*50.—MINE TIMBERING.—One credit per quarter. Second quarter. One lecture. Laboratory deposit, \$1.00. DANIELS.

A study of the materials and methods used in timbering shafts, tunnels and drifts in hard and soft ground. Particular attention is paid to those methods used by military engineers in the war.

51.—ELEMENTS OF MINING.—Three credits per quarter. First quarter. Three lectures. Prerequisite, sophomore standing. DANIELS.

A general study of the field of mining, considering prospecting, boring, drilling, explosives, rock breaking, methods of development and working, transportation and drainage.

101.—MILLING.—Three credits per quarter. First quarter. Two lectures and one laboratory period. Prerequisite, junior standing. Laboratory deposit, \$5.00. ROBERTS, DANIELS, HOLBROOK.

Lectures and mill practice in the principles of ore dressing. During the war the study and practice will be confined to war minerals.

*103.—MINE RESCUE TRAINING.—One credit per quarter. Second quarter. DANIELS, CHISHOLM.

Practice in the care and use of oxygen rescue apparatus, smoke-room training, and first-aid-to-the-injured work at the U. S. Bureau of Mines Rescue Station. Twenty-five hours' instruction. Required of all students in the College of Mines. This course is of particular military value in training men in the use of gas masks and helmets.

106.—MINING EXCURSION.—Three credits per quarter. Third quarter. Expenses, \$20.00 to \$40.00. ROBERTS, DANIELS, COREY.

A two weeks' excursion, taken in June of each year, to a neighboring mining region; detailed examinations of mining and metallurgical industries.

120.—COAL RESOURCES OF NORTH AMERICA.—Three credits per quarter. Second quarter. Three lectures. Prerequisite, course 51. DANIELS.

The occurrence of coal in North America with especial reference to geographic and geologic distribution and structure; study of the various types of coals; classification of coals; commercial requirements of coals.

122.—COAL MINING METHODS.—Three credits per quarter. Second quarter. Three lectures. Prerequisite, courses 51 and 120. DANIELS.

Methods of prospecting coal seams; determination of structure and content; methods of development and working, timbering, etc. A detailed study is made of a nearby mine.

151.—MINING ENGINEERING.—Five credits per quarter. First quarter. Three lectures, one laboratory and excursions. Prerequisite, senior standing. Laboratory deposit, \$3.00. ROBERTS, HOLBROOK.

Lectures on exploration, mine development and operation, with costs, power generation, air compression, hoisting and transportation. Practice with air compressors, machine drills and mine equipment in laboratories and local plants. During the war this course will specialize in the military

* War courses open to non-technical students.

uses of surface and underground excavation, pumping and drainage, transportation and explosives.

152.—ORE DRESSING.—Five credits per quarter. Third quarter. Three lectures and two laboratory periods. Prerequisite, senior or graduate standing. Laboratory deposit, \$5.00.

ROBERTS, DANIELS, HOLBROOK.

A detailed study of certain branches of ore dressing accompanied by mill tests of ores checked by assays. During the remainder of the war as during 1917-1918 the study and practice will be confined to ores of the metals especially required for war purposes.

153.—THESIS OUTLINE.—One credit per quarter. First quarter. One laboratory period. Prerequisite, senior or graduate standing.

ROBERTS, DANIELS, COREY.

The outlining of senior thesis, the gathering of material, study of references, making of drawing, maps, etc. See course 154-155. During the remainder of the war as during 1917-1918 all theses are to be on subjects of direct application to war purposes.

154-155.—THESIS.—Two credits per quarter. Second and third quarters. Two laboratory periods. Prerequisite, course 153.

ROBERTS, DANIELS, COREY.

A continuation of course 153. Weekly consultation and seminars. A deposit of \$5.00 or \$10.00 will be required to cover cost of materials and equipment in thesis work involving the use of mining or metallurgical equipment.

158.—MINING LAW.—Two credits per quarter. Second quarter. Two lectures.

O'BRYAN.

A series of lectures on the mining laws of the United States and Alaska. Illustrated by diagrams and mine maps.

171.—MINE GASES AND VENTILATION.—Three credits per quarter. Second quarter. Three lectures. Prerequisite, course 122. DANIELS.

Composition and properties of mine gases, methods of testing. Lighting of mines. Principles of ventilation; ventilating machinery.

172.—COAL MINING PLANT.—Three credits per quarter. Third quarter. Three drafting periods. Prerequisite, senior standing. DANIELS.

Design of plant and machinery employed in mining and preparing coal for market.

174.—COAL MINING MACHINERY.—Three credits per quarter. Third quarter. Three lectures. Prerequisite, senior standing. DANIELS.

Study of coal cutting machines, mine locomotives, fans, hoists, pumps, and tippie or breaker machinery with especial reference to application to coal mining.

176.—COAL WASHING.—Five credits. Second quarter. Three lectures and two laboratory periods. Prerequisite, course 101, Met. 103. Laboratory deposit, \$5.00.

DANIELS.

A detailed study of methods of preparing coal for market, together with laboratory tests and runs on various coals to determine best methods of preparation.

182.—MINE MANAGEMENT.—Three credits per quarter. Third quarter. Three lectures. Prerequisite, senior standing. DANIELS.

A study of the organization and administration of engineering plants, involving the keeping and interpretation of cost accounts, the efficiency of labor and methods, the financial, legal and social aspects of engineering operation.

301.—MINING METHODS.—Three credits per quarter. Second quarter. Three lectures. Prerequisite, senior or graduate standing. ROBERTS.
An advanced study of mining methods.

302.—MINE OPERATION.—Three credits per quarter. Third quarter. Prerequisite, senior or graduate standing. ROBERTS.

The complete operations at a few typical mines, including mining, transportation and treatment of ore, disposal of products, company, finances and management. Illustrated by ores and products, maps and photographs, cost sheets, engineering and financial reports of the mines studied.

303.—SEMINAR.—One credit per quarter. First, second and third quarters. Prerequisite, senior or graduate standing. Required of Bureau of Mines fellowship holders.

Lectures and discussions by Bureau of Mines staff and College of Mines faculty.

II. METALLURGY.

*70.—WAR ALLOYS.—Three credits per quarter. Third quarter. Two quarters. Three lectures and recitations. Prerequisite, general chemistry. COREY.

An outline of the metallurgy of the metals most used in the war. The minerals and ores of the war metals; the metallurgical processes used to extract the metals; the production, markets, prices and uses of each.

*71.—WAR ALLOYS.—Three credits per quarter. Third quarter. Two lectures and recitations. Prerequisite, general chemistry.

The properties and uses of the war metals and alloys and their manufacture into ordnance, munitions and equipment. A course designed for non-technical students expecting to enter the service.

101.—FIRE ASSAYING.—Five credits per quarter. First quarter. One lecture and three laboratory periods. Prerequisite, Chem. 101. Laboratory deposit, \$20.00. COREY, GLENN, SLACK.

The testing of reagents, the crushing, sampling and assaying of ores, furnace and mill products for lead, silver, gold and tin; also, the assay of base and gold bullion.

102.—GENERAL METALLURGY.—Five credits per quarter. Third quarter.

* War courses open to non-technical students.

ter. Three lectures and two laboratory periods. Prerequisite, course 101. Laboratory deposit, \$10.00. COREY.

The properties of metals and alloys, fuels, refractory materials, furnaces and the extraction of the common metals from their ores. Visits to smelters.

103.—METALLURGICAL FUELS.—Three credits per quarter. First quarter. Two lectures and one laboratory period. Prerequisite, junior standing. Laboratory deposit, \$5.00. DANIELS.

The analysis of fuels and a consideration of the most effective utilization of the country's present supplies. The course will follow the outline recommended by the United States Fuel Administration.

104.—COPPER AND LEAD.—Three credits per quarter. Third quarter. Three lectures. Prerequisite, junior standing. COREY.

The metallurgy of copper and lead, especially the methods of roasting, smelting and refining.

106.—REFRACTORIES.—Two credits per quarter. Third quarter. One lecture and one laboratory period. Laboratory deposit, \$3.00. COREY.

Methods of testing clays, refractory materials, cement-making materials.

151.—GOLD AND SILVER.—Three credits per quarter. First quarter. Three lectures. Prerequisite, course 102. COREY.

Amalgamation, cyaniding, and chlorination of gold and silver ores.

153.—WET ASSAYING.—Three credits per quarter. First quarter. One lecture and two laboratory periods. Prerequisite, Course 102, Chem. 101. Laboratory deposit, \$12.00. COREY.

Technical methods for the determination of copper, lead, zinc, etc., in ores and furnace products, etc.

*155.—IRON AND STEEL.—Three credits per quarter. First quarter. Three lectures. Prerequisite, junior standing. DANIELS.

The metallurgy and manufacture of commercial iron and steel, with especial reference to their properties and uses in engineering work.

Of especial importance to men who intend to enter ordnance or quartermaster work in the army, or naval construction work in the navy.

157.—DESIGN OF PLANT.—Three credits per quarter. Third quarter. Three drafting periods. Prerequisite, senior or graduate standing. ROBERTS, DANIELS.

The designing of a piece of equipment or a structure for mining, milling or metallurgical purposes.

158.—MINOR METALS.—Three credits per quarter. Second quarter. Three lectures. COREY.

The metallurgy of zinc, antimony, tin, aluminum, nickel, etc., a study of the plant required, the methods and costs of treatment.

160.—METALLURGICAL ANALYSIS.—Three credits per quarter. Second

* War courses open to non-technical students.

quarter. One lecture and two laboratory periods. Prerequisite, Chem. 101. Laboratory deposit, \$12.00. COREY.

Technical methods of analysis of slags and industrial products.

162.—METALLOGRAPHY.—Two credits per quarter. Second quarter. Two lectures. Prerequisite, junior standing. DANIELS.

The constitution and microstructure of metals and alloys, especially iron and steel.

163.—METALLOGRAPHY.—Two credits per quarter. Third quarter. Two laboratory periods per week. COREY.

The preparation and study of metal sections, photomicrography and the use of the microscope to aid in testing industrial alloys.

†164.—PYROMETRY AND ALLOYS.—Two credits per quarter. Third quarter. One lecture and one laboratory period. Laboratory deposit, \$5.00. COREY.

Methods of measuring high temperatures. Union of metals by fusion, compression and electro-deposition; the behavior of metals and alloys under heat. Laboratory practice in thermal measurements, synthesis and testing of alloys.

165.—METALLURGY CALCULATIONS.—Two credits per quarter. Second quarter. Two lectures. Prerequisite, course 102, Chem. 101.

COREY.

Physical chemistry for the metallurgist, slag calculations, etc., illustrated by figures quoted from the present practice at a number of smelting plants.

166.—ELECTRO-METALLURGY.—Three credits per quarter. Third quarter. Three lectures. Prerequisite, senior or graduate standing.

COREY.

A study of methods and practices with special consideration of the possibilities of electro-metallurgical industries in the Pacific Northwest.

THESIS.—See Mining 153 and 154-155.

SUMMER FIELD WORK.—See Mining 106.

† Not offered in 1918-19.

III. MINING AND METALLURGICAL RESEARCH

MINES HALL AND BUREAU OF MINES HALL

THE TECHNICAL STAFF OF THE PACIFIC NORTHWEST STATION, UNITED STATES BUREAU OF MINES: THOMAS VARLEY, SUPERINTENDENT AND METALLURGIST IN CHARGE; WILL HAWES COGHILL, METALLURGIST; GEORGE WATKIN EVANS, COAL MINING ENGINEER; FRANCIS C. RYAN, ELECTRO-METALLURGIST; HARLIN A. DEPEW, ASSISTANT PHYSICAL CHEMIST; CLYDE WILLIAMS, ASSISTANT METALLURGICAL CHEMIST.

In co-operation with the instructors in the College of Mines.

Class work will be directed by members of the instructional staff of the University. The research work is under the joint direction of the United States Bureau of Mines and the College of Mines. The subjects of research relate to the mining and metallurgical industries of the state and adjacent regions.

During the coming year investigations are contemplated in the following subjects:

1. Electro-metallurgical processes.
2. Beneficiation of coal and non-metallic minerals.
3. Clay industry and ceramics.
4. General problems affecting the ores and the mining industry of the state.
5. The development of metallurgical industries.

SUBJECTS PRESENTED BY DEPARTMENTS OF OTHER COLLEGES OF THE UNIVERSITY

CHEMISTRY

BAGLEY HALL

1, 2, 3.—GENERAL CHEMISTRY.—Five credits per quarter. First, second or third quarter. Three lectures and two laboratory periods. Laboratory deposit, \$7.00. LANGDON.

The first two quarters are devoted to general chemistry and the chemistry of the non-metals; the third quarter to the chemistry of metals. Laboratory work of the third quarter is qualitative analysis.

21, 22, 23.—GENERAL CHEMISTRY.—Five credits per quarter. First, second or third quarter. Three lectures and two laboratory periods per week. Prerequisites, accredited high school course in chemistry. Laboratory deposit, \$7.00. LANGDON.

A course designed for students who have had a high school course in chemistry, especially for students of the Colleges of Science and Engineering.

101. QUANTITATIVE ANALYSIS.—Four credits per quarter. Second quarter. One lecture and three laboratory periods per week. Laboratory deposit, \$7.00. HEATH.

A course in the elements of quantitative methods, gravimetric analysis and volumetric methods.

*204.—ELECTRO CHEMISTRY.—Five credits per quarter. Third quarter. Three lectures and two laboratory periods per week. BYERS.

CIVIL ENGINEERING

ENGINEERING HALL

1.—ENGINEERING DRAWING.—Three credits per quarter. First, second or third quarter. Prerequisite, plane geometry. Laboratory deposit, \$1.00. WARNER, ROGERS, SNELL.

The use of instruments, freehand lettering, drawing from machine parts, tracing, platting of traverse from field notes.

2.—ENGINEERING DRAWING.—Three credits per quarter. First, second or third quarter. Prerequisite, course 1.

WARNER, ROGERS, SNELL.

Fundamental principles of making views of objects occupying three dimensions of space. Drafting-room methods of solving problems requiring two or more views.

11.—ENGINEERING PROBLEMS.—Three credits per quarter. First, second or third quarter. DUCKERING, ROGERS, WARNER, HAMILTON.

The investigation of simple structures as to loadings, weights and stresses in members by algebraic and graphic methods.

12.—ENGINEERING PROBLEMS.—Three credits per quarter. First, second or third quarter. Prerequisite, course 11.

DUCKERING, ROGERS, WARNER, HAMILTON.

Elementary problems dealing with the movement of bodies. Investigation of the effects of bending and direct stress upon the materials of construction. Introduction of the ideas of calculus and analytics.

13.—ENGINEERING PROBLEMS.—Three credits per quarter. First, second or third quarter. Prerequisite, course 12.

DUCKERING, ROGERS, WARNER.

The problems of elementary machines, algebraic and graphic solution. The elasticity of materials. Hydrostatics.

21.—PLANE SURVEYING.—Three credits per quarter. First, second or third quarter. Prerequisite, course 12, 1, Math. 51. All freshman engineers. Laboratory deposit, \$3.00. HAYDEN, HAMILTON.

Adjustment of instruments, trigonometric computations, mapping of simple surveys, and a brief introduction to the U. S. system of public land surveying.

131.—MECHANICS.—Three credits per quarter. First quarter. Prerequisite, course 13, Math. 62. DUCKERING, WERNECKE.

Statics. Stresses in structures, beams, columns, flexible cords. Influence lines. Theorem of Least work. Theorem of Three Moments. Combined stresses. Centroids and Second Moments.

* Not offered in 1918-1919.

132.—MECHANICS.—Three credits per quarter. Second quarter. Pre-requisite, course 131. DUCKERING, WERNECKE.

Dynamics. Translation and rotation. Work, energy and power friction. Torsion. Inertia of rigid bodies.

142.—HYDRAULICS.—Five credits per quarter. Third quarter. Pre-requisite, course 13. Laboratory deposit, \$3.00. HARRIS, ROGERS.

Flow of water through pipes and orifices, over weirs and in open channels; energy, impulse and reaction of jets with application to impulse wheels. Review of hydrostatics.

ECONOMICS

COMMERCE HALL

51.—MAN AND HIS ECONOMIC LIFE.—Five credits per quarter. First and third quarters. Prerequisite, sophomore standing.

ELECTRICAL ENGINEERING

ENGINEERING HALL

101-102.—DIRECT CURRENTS.—Five credits per quarter. Soph.; Ch. E., C. E., E. E., M. E., Min. E. Prerequisite, Physics 98.

121.—ALTERNATING CURRENTS.—Five credits per quarter. Junior: M. E., Ch. E., C. E., Min. E. Prerequisite, course 101. To be taken in connection with course 101. LOEW, KIRSTEN.

A short course in alternating currents for non-electrical students.

ENGLISH

DENNY HALL

5-6.—COMPOSITION FOR ENGINEERS.—Three credits per quarter. First, second or third quarter.

GEOLOGY

SCIENCE HALL

5.—ENGINEERING GEOLOGY.—Five credits per quarter. First quarter. Three class and two laboratory periods per week. Primarily for mining students, chemical and civil engineers. Laboratory deposit, \$1.00. CULVER.

A survey of the field of general geology. Occasional field trips. This course, modified to suit the special needs of students in forestry is repeated in the third quarter.

21.—MINERALOGY.—Three credits per quarter. Second quarter. Two lectures and one laboratory period per week. Laboratory deposit, \$3.00. CULVER.

A brief study of crystallography followed by descriptive mineralogy and blow-pipe methods. A knowledge of chemistry is essential and general geology is desirable. One or more field trips to some mineral center.

22.—PETROLOGY.—Three credits per quarter. Third quarter. Two lectures and one laboratory period with occasional field trips. Laboratory deposit, \$2.00. CULVER.

A study of rocks, their components, occurrence and structural relations.

123. OPTICAL MINERALOGY. Four credits per quarter. First quarter. Two lectures and two laboratory periods per week. Prerequisite, course 5 or equivalent, 21, 22. Laboratory deposit, \$2.00. CULVER.

The use of the polarizing microscope in the examination of minerals and rocks in thin sections.

124. PETROGRAPHY. Four credits per quarter. Second quarter. Two lectures and two laboratory periods per week. Prerequisite, course 123. Laboratory deposit, \$2.00. CULVER.

The principles of petrography and petrographic methods in the systematic study of igneous, sedimentary and metamorphic rocks.

125.—ADVANCED PETROGRAPHY.—Two credits with additional credits optional. Third quarter. Prerequisite, course 124. CULVER.

A continuation in the work in petrography, for majors in mining and geology. Primarily a study of igneous rocks and their relations.

127-128. ECONOMIC GEOLOGY. Five credits per quarter. First and second quarters. Three lectures and discussion of papers. Prerequisite, courses 1 or 5, or 12, 22, 124. LANDES.

A study of the origin and extent of economic deposits of non-metals (first quarter), and metals (second quarter), their production and use.

131-132. INVERTEBRATE PALEONTOLOGY. Three credits per quarter. First and second quarters. Two lectures and one laboratory period per week. Prerequisite, course 31. May well be followed by courses 133 or 134. WEAVER.

A detailed systematic biologic study of fossil and living representatives of the Mollusca. First quarter, Pelecypoda; second quarter, Gastropoda.

LAW

Commerce Hall

54-55-56. BUSINESS LAW. Three credits per quarter. First, second and third quarters. AYER.

This course covers the fundamental principles of law. The more general and practical principles are developed from problems and selected cases, particularly as related to the law of contracts, property, agency, negotiable paper, insurance, partnership and corporation, with special lectures as to statutory regulations.

MATHEMATICS

Science Hall

51. ALGEBRA. Three credits per quarter. First, second or third quarter. Prerequisite, one and one-half years algebra, one year plane geometry.

Primarily for students in the colleges of Engineering and Mines.

52. PLANE TRIGONOMETRY. Three credits per quarter. Prerequisite, course 51. First, second or third quarter.

Primarily for students in the colleges of Engineering and Mines.

53. ANALYTICAL GEOMETRY. Three credits per quarter. First, second or third quarter. Prerequisite, course 52.

Primarily for students in the colleges of Engineering and Mines.

61-62-63. CALCULUS I, II, III. Three credits per quarter. First, second and third quarters. Prerequisites, courses 2, 53.

Primarily for students in the colleges of Engineering and Mines.

MECHANICAL ENGINEERING

Engineering Hall

1, 2, 3. WOODWORK. One credit per quarter. First, second or third quarter. Bench work, cabinet work. Pattern making. Laboratory deposit, \$2.00. BEATTIE.

4. WOODWORK. One credit per quarter. Third quarter. Prerequisite, Mining 50. Mine timber framing. Laboratory deposit, \$2.00. DANIELS, BEATTIE.

53, 54, 55. METALWORK. One credit per quarter. First, second or third quarter. Foundry, forge, machine work. Laboratory deposit, \$2.00. KANE.

82. STEAM ENGINEERING. Three credits per quarter. First, second or third quarter. Not open to freshmen. Prerequisite, C. E. 2. EASTWOOD.

The various forms of steam apparatus used in modern power plants, considering the construction, use and reason for installing such apparatus.

105-106-107. METALWORK. One credit per quarter. First, second and third quarters. Prerequisite, course 55. Laboratory deposit, \$2.00. KANE.

Advanced machine shop practice, nutting machine.

140. STEAM ENGINEERING LABORATORY. Three credits per quarter. First, second or third quarter. Preceded or accompanied by course 82. Laboratory deposit, \$2.00. WILSON.

Calibrations of thermometers, gages, indicator springs, etc. Friction and mechanical efficiency tests of the simple steam engine. One complete engine and boiler test with report.

MILITARY SCIENCE AND TACTICS

The Armory

A course of two years in military training is required. All able-bodied male students except those from foreign countries, not intending to become naturalized, must take the course which by regulation of the University is required during the first and second years. Furthermore, every male undergraduate student is required to take physical exercise or athletics during each week of his attendance at the University, unless excused by his dean and the physical director.

MODERN LANGUAGE

Denny Hall

For description of courses in modern languages, see bulletin of the College of Liberal Arts.

PHYSICS

Denny Hall

97-98-99. PHYSICS FOR ENGINEERS. Five credits per quarter. First, second and third quarters. Three class and two three-hour laboratory periods per week. Prerequisite, high school physics and fifteen hours of college mathematics. BRAKEL.

ZOOLOGY

Science Hall

15. EVOLUTION AND EUGENICS. Three credits per quarter. KINCAID. Lectures upon the principles of evolution and their relation to human welfare.

16. ETHNOLOGY. Two credits per quarter. KINCAID.

The origin, distribution and characteristics of the races of man.

WINTER SESSION FOR MINING MEN

The twenty-third annual short session for mining men will open on January 2, 1919, continuing until March 29. During this period each year twelve of the instructors in mining engineering offer a course for the benefit of persons who are interested in prospecting, mining, milling, assaying or smelting. Admission to the class is without examination. No previous preparation, training or mining experience is necessary to enter the course, other than ability to read and write English. Many practical men with an interest in some branch of mining but without much education have obtained satisfactory results from the course; others with a college education and mining experience have gained much up-to-date training and information. The past experience and future aims of each student are taken into consideration, and the character of his work arranged accordingly. Prospectors and mining men may bring in their own ores and minerals for study, for assay, or for concentration tests, either by ordinary wet methods or by flotation.

Instruction is given by lectures, laboratory exercises, and visits to mines and plants in operation. Each year a group of mining men is engaged to give special lectures during the period of the short session. These men represent the fields of coal, metal and placer mining, smelting, assaying and milling.

Three general groups of studies are offered:

- (1) Quartz mining
- (2) Placer mining
- (3) Coal mining

1. QUARTZ MINING

For men interested in quartz or lode mining, the course outlined consists of geology, mineralogy, mining, milling, field trips, mining law, surveying, chemistry and fire assaying. Optional subjects are forge and foundry, mine timber framing, and mine rescue and first aid training.

2. PLACER MINING

The placer mining group embraces surveying, hydraulic mining, placer mining, geology, mineralogy, mining, milling, mining law, and forge and foundry.

3. COAL MINING

For coal miners the courses consist of coal analysis, coal washing, gas and lamp testing, mine rescue and first aid training, chemistry, geology, mineralogy and surveying.

GENERAL INFORMATION

Full descriptions of all these subjects are given in the following pages. Students need not enroll for all the subjects listed in a group and changes in the choice of subjects in each group may be made, depending on the individual circumstances. For students who returned a second year, special courses are arranged in continuation of their previous work.

No charges are made in the course, except the tuition fee of ten dollars required of all students in the University, but each student makes deposits for laboratory supplies actually used and also buys his own books. The deposits in the various courses are stated under the description of the subjects. Books and supplies will average about ten dollars. The total cost of the full course is less than thirty dollars in the placer group for the three months and fifty dollars in the quartz mining studies. All deposits are made at the beginning of the course.

Rooms and board may be obtained in the University district at twenty-five to thirty dollars per month. The University operates a cafeteria, the cost of board averaging about twenty dollars per month. Several good restaurants are located close to the University. A list of boarding and rooming houses is kept on file at Mines Hall for the benefit of prospective students. The advantages of the University, such as the use of library, gymnasium, showers and the privilege of attending lectures, concerts and assemblies, are open to all winter session students.

Students who satisfactorily complete a course of study are given upon request a certificate stating the amount and character of the work done.

TIME SCHEDULE, WINTER SESSION, COLLEGE OF MINES

	8:00	9:00	10:00	11:00	1:00-5:00
Mon.	Milling DANIELS Mines Hall	Geology, CULVER Science Hall	Mineralogy CULVER, Science Hall		Survey Field Work, Mines Hall or Forge and Found- ry. KANE Foundry Bldg.
Tues.	Mining Law O'BRYAN Commerce Hall	Mining, ROBERTS Mines Hall	Chemistry BENSON Bagley Hall	Milling DANIELS Mines Hall	Mining & Milling Laboratory Mines Hall
Wed.	Surveying Mines Hall	Geology, CULVER Science Hall	Mineralogy CULVER, Science Hall		Fire Assaying Laboratory COREY Mines Hall
Thurs.	Mining Law O'BRYAN Commerce Hall	Mining, ROBERTS Mines Hall	Chemistry BENSON Bagley Hall	Fire Assaying COREY Mines Hall	Fire Assaying Laboratory COREY Mines Hall
Fri.	Surveying Mines Hall	Mining, ROBERTS Mines Hall	Chemistry BENSON Bagley Hall	Milling DANIELS Mines Hall	Chemistry Labor- atory, BENSON Bagley Hall
Sat.	Surveying, field work or field trips.			(Time of other courses to be arranged)	

SUBJECTS IN THE WINTER MINING SESSION

MINING S. C. 1. Mining lectures on prospecting, development, boring, air-compression, drilling, mining systems, timbering and transportation. Practice in air-compression, machine drilling and sampling. Study of mine maps, ore deposits and mining districts. Three lectures and one laboratory period per week. ROBERTS.

MINING S. C. 2. Milling. Lectures and recitations on ore treatment and concentration. Laboratory practice in sampling, testing, and dressing, using breakers, rolls, screens, stamp battery, tables, vanners, jigs, electro-magnetic and flotation machinery. Three lectures and one afternoon per week. Laboratory deposit, \$3.00. DANIELS.

MINING S. C. 3. Placer Mining. Lectures and laboratory work in methods of placer mining. Laboratory practice in panning, sluicing, amalgamation, retorting, assaying of bullion. Lectures on testing and valuing placer ground, methods of operation, thawing, sluicing, dredging. Study of formation of placers and of type localities. Laboratory deposit, \$2.00 Two lectures and one afternoon per week. —

MINING S. C. 4. Field Trips. An outline study of the operations at neighboring mines, mills, and smelters; geological field studies, followed by laboratory practice on the rocks and minerals found. Saturdays. ROBERTS, DANIELS, COREY.

METALLURGY S. C. 1. Fire Assaying. Lectures on sampling, preparing ores for assay, furnaces, fuels, reagents, and the fire assay of gold, silver and lead ores. The laboratory work includes the testing of reagents, and the assaying of various ores. One lecture and two afternoons a week in laboratory. Laboratory deposit, \$15.00. COREY.

METALLURGY S. C. 2. A study of the principles of metallurgy for the benefit of those who are engaged in the metal trades or in the mining of ores requiring smelter treatment. Two lectures and one afternoon a week. Laboratory deposit, \$5.00. COREY.

METALLURGY S. C. 3. Wet assaying. Technical methods for the determination of copper, lead, zinc, etc., in ores and smelter products. Two afternoons a week. Laboratory deposit, \$10.00. COREY.

CHEMISTRY S. C. 4. GENERAL CHEMISTRY AND QUALITATIVE ANALYSIS. Laboratory practice in the determination of the common elements. Three lectures a week, and one laboratory. Laboratory deposit, \$7.00. BENSON.

GEOLOGY S. C. 2. MINERALOGY. Instruction and practice in blowpipe analysis, with lectures upon the common minerals, and practice in the identification of minerals by field tests. Two two-hour laboratory periods per week. Laboratory deposit, \$2.00. CULVER.

GEOLOGY S. C. 3. ELEMENTS OF GEOLOGY. Lectures on the elements of geology, the common variety of rock, metalliferous vein and ore deposits, etc. Two lectures per week. CULVER.

MINING LAW. A series of lectures on the mining laws of the United States and Alaska. Illustrated by drawings and mine maps. Two lectures per week. O'BRYAN.

SURVEYING. (C. E. 38.) Instruction and field practice in the use of simple instruments for making underground and surface surveys; the elements of drawing, lettering, sketch-mapping and field notes; the rules governing mineral surveys. Two lectures and two laboratory periods per week. Laboratory deposit, \$3.00. HAYDEN.

HYDRAULIC MINING. (C. E. 144.) The elements of hydraulics; the flow and measurement of water in pipes, flumes and ditches with special reference to placer mining. Two lectures a week. HARRIS.

FORGE. Practice in sharpening and tempering drill steel and picks; systematic training in the making and care of fires, and the application of various heats, drawing, punching, riveting, bending, twisting, upsetting, welding iron and steel, and making and tempering machine tools. Laboratory deposit, \$2.00. One afternoon a week. KANE.

MINE TIMBER FRAMING. Shop work in the cutting, framing and erection of various types of timbers employed in mining operations. Laboratory deposit, \$2.00. One afternoon a week. BEATTIE, DANIELS.

MINING 103. MINE RESCUE TRAINING. Twenty-five hours' instruction. Practice in the care and use of oxygen rescue apparatus, smoke-room training, and first-aid-to-the-injured at the U. S. Bureau of Mines Rescue Station. DANIELS, CHISHOLM.

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GRADUATE SCHOOL

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PUGET SOUND BIOLOGICAL STATION

BULLETIN OF VOCATIONAL COURSES

OFFICIAL DIRECTORY

Requests for bulletins, or for general information in regard to the University, and all credentials and correspondence relative to admission, advanced standing, or requirements for graduation should be addressed to THE REGISTRAR, University of Washington, Seattle, Washington.

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BULLETIN
UNIVERSITY OF WASHINGTON

GENERAL SERIES

MARCH 22, 1935

No. 395

COLLEGE OF MINES

1935-1936

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UNIVERSITY OF ILLINOIS



SEATTLE, WASHINGTON

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THE UNIVERSITY CALENDAR

1935-1936

AUTUMN QUARTER

Pre-registration dates.....May 6 to May 31; June 24 to Sept. 13
 Pre-registration dates (for Engineering College).....May 6 to May 31; Sept. 2 to Sept. 13
 Latest day to avoid increase in Incidental Fee.....Friday, Sept. 6
 Section reservations will be cancelled if tuition is not paid by.....Friday, Sept. 13
 Registration dates for students who do not pre-register.....Sept. 14 to 26, inclusive
 Last registration day before beginning of instruction.....Thursday, September 26
 Freshman Week.....Begins Friday, Sept. 27, 8:30 a.m.; ends Saturday, Sept. 28
 College Aptitude Test.....Saturday, Sept. 28, at 8 a.m.
 Instruction begins.....Tuesday, October 1
 Last day for registration with late fee, and to add a course.....Monday, Oct. 7, 4:30 p.m.
 President's annual address.....Friday, October 4, 11 a.m.
 Regular meeting of faculty.....Tuesday, October 22, 4 p.m.
 Latest day to withdraw and receive a "W" without grade.....Monday, October 28, 4:30 p.m.
 President's Reception to Parents of New Freshmen...Tuesday, November 26, 7:30-10 p.m.
 Thanksgiving recess begins.....Wednesday, Nov. 27, 6 p.m.
 Thanksgiving recess ends.....Monday, December 2, 8 a.m.
 Regular meeting of faculty.....Tuesday, December 10, 4 p.m.
 Instruction ends.....Friday, December 20, 6 p.m.

WINTER QUARTER

Pre-registration dates.....Nov. 1 to Dec. 20
 Latest day to avoid increase in Incidental Fee.....Thursday, December 12
 Section reservations will be cancelled if tuition is not paid by.....Friday, December 20
 Registration dates for students who do not pre-register.....Dec. 21 to Jan. 4, 12 m.
 Last registration day before the beginning of instruction.....Saturday, Jan. 4, 12 m.
 Instruction begins.....Monday, Jan. 6, 8 a.m.
 Last day for registration with late fee and to add a course.....Saturday, Jan. 11, 12 m.
 College Aptitude Test.....Monday, Jan. 13, 12 m.
 Regular meeting of faculty.....Tuesday, Jan. 28, 4 p.m.
 Latest day to withdraw and receive a "W" without grade.....Saturday, Feb. 1, 12 m.
 Washington's birthday (Founders' Day).....Saturday, Feb. 22
 Regular meeting of faculty.....Tuesday, March 10, 4 p.m.
 Instruction ends.....Friday, March 20, 6 p.m.

SPRING QUARTER

Pre-registration dates.....Feb. 6 to March 20
 Latest day to avoid increase in Incidental Fee.....Friday, March 13
 Section reservations will be cancelled if tuition is not paid by.....Friday, March 20
 Registration dates for students who do not pre-register.....March 21 to March 28, 12 m.
 Last registration day before beginning of instruction.....Saturday, Mar. 28, 12 m.
 Instruction begins.....Monday, Mar. 30, 8 a.m.
 Last day for registration with late fee, and to add a course.....Saturday, Apr. 4, 12 m.
 College Aptitude Test.....Monday, April 6, 12 m.
 Regular meeting of faculty.....Tuesday, April 21, 4 p.m.
 Latest day to withdraw and receive a "W" without grade.....Saturday, April 25, 12 m.
 Memorial Day (holiday).....Saturday, May 30
 Regular meeting of faculty.....Tuesday, June 2, 4 p.m.
 Instruction ends.....Friday, June 12, 6 p.m.
 Class Day and Alumni Day.....Saturday, June 13
 Baccalaureate Sunday.....Sunday, June 14
 Commencement.....Monday, June 15

SUMMER QUARTER

1936

Pre-registration dates.....April 27 to June 13, 12 m.
 Latest day for securing reserved sections by payment of fees for students
 who pre-register (1st term).....Saturday, June 13, 12 m.
 Last registration day before beginning of instruction.....Tuesday June 16
 Instruction begins.....Wednesday, June 17, 8 a.m.
 College Aptitude Test.....Monday, June 29, 12 m.
 Last day to add a course (1st term).....Friday, June 19, 4:30 p.m.
 Last day to add a course (full quarter).....Tuesday, June 23, 4:30 p.m.
 Latest day to withdraw and receive a "W" without grade
 (1st term).....Tuesday, June 30, 4:30 p.m.
 Independence Day (holiday).....Saturday, July 4
 Latest day to withdraw and receive a "W" without grade
 (full quarter).....Tuesday, July 14, 4:30 p.m.
 Regular meeting of faculty.....Tuesday, July 14, 4 p.m.
 First term ends.....Friday, July 24, 6 p.m.
 Latest day for securing reserved sections by payment of fees
 (2nd term).....Friday, July 24, 4:30 p.m.
 Last registration day before beginning of instruction (2nd term).....Saturday, July 25, 12 m.
 Second term begins.....Monday, July 27, 8 a.m.
 Last day to add a course (2nd term).....Wednesday, July 29, 4:30 p.m.
 Latest day to withdraw and receive a "W" without grade
 (2nd term).....Saturday, Aug. 8, 12 m.
 College Aptitude Test.....Monday, Aug. 3, 12 m.
 Regular meeting of the faculty.....Tuesday, Aug. 18, 4 p.m.
 Instruction ends.....Thursday, Aug. 27, 6 p.m.

LABORATORIES

The headquarters of the College of Mines are in Mines Laboratory, a steel-frame building, which has an area of 57 by 162 feet and a height of 58 feet, with four full floors and mezzanine decks. The building, in addition to the laboratories, contains the offices, classrooms, and library of the departments of mining, metallurgical, and ceramic engineering, and the offices of the Northwest Experiment Station of the United States Bureau of Mines, which makes joint use of the College of Mines equipment.

Complete equipment is available for carrying on laboratory instruction, technical investigations and tests, and research studies. The cost of the building and equipment to date has exceeded one-third of a million dollars.

Mining. The mining equipment is divided into three groups, as follows: exhibits designed for purposes of study, laboratory apparatus for experiment and practice, and field equipment.

Ore Dressing. The laboratory was designed for testing not only ores but also non-metallic mineral substances, which are of great importance in Washington and the Northwest. The equipment is new and complete; much of it is of standard size.

Metallurgy. Separate laboratories are provided for general metallurgy, fire assaying, wet analysis, fuels, electrolytic work, research, and metallography, besides the balance rooms, dark room, and stock room.

Coal Washing. The coal section of Mines Laboratory occupies an area of 54 by 57 feet and a height of 70 feet, including four stories and a sub-basement, connected by electric elevator. Full-size equipment is provided for receiving and storing a carlot of coal, followed by picking, elevating, screening, jigging, classifying, tabling, and air-tabling. This portion of the building also contains fuel and analytical laboratories for the College of Mines and the U. S. Bureau of Mines, a room for conducting float-and-sink tests, a sampling room, and a coal-crushing and grinding room for the preparation of samples.

Ceramics. The ceramics apparatus is used for washing, purifying, and preparing ceramic and non-metallic raw materials, and for the manufacture and testing of finished ceramic products.

MINING, METALLURGICAL, AND CERAMIC RESEARCH

The department aims to encourage development in the mining, metallurgical, and ceramic industries of Washington, the Pacific Northwest and Alaska by research in the special problems presented, and to solve the problems through the efforts of fellowship holders and others studying in the department.

Graduates from suitable technical courses at institutions of recognized standing, or men who present evidence of technical training that has fitted them to undertake investigations, are eligible to enroll in mining and metallurgical research. The degree of master of science may be granted students holding suitable bachelor of science degrees who complete investigative work in compliance with the University requirements for the master's degree. Although as much latitude as possible will be allowed in the choice of subjects for research, the general topics will be those of special importance to this region.

Research Fellowships. The College of Mines offers four fellowships for research in coal and other non-metallic mineral substances, in cooperation with the United States Bureau of Mines. The fellowships are open to graduates of universities and technical colleges who are properly qualified to undertake research investigations. The value of each fellowship is about \$714 to the holder, for the 12 months beginning July 1. Fellowship holders register as graduate students and become candidates for the degree of master of science in the proper subject, unless an equivalent degree has previously been earned.

Each applicant should send a copy of his collegiate record from the registrar of the college where he has graduated, or will graduate in June. He should also send a photograph and a detailed statement of his professional experience, if any, and give the names and addresses of at least three persons who are familiar with his character, training, and ability. Applications should be submitted by April 1, and should be addressed to the Dean, College of Mines, University of Washington, Seattle, Washington.

Appointees to the fellowship report for duty on July 1, and are required to be on duty for a full year, except that in case of reappointment for a second year, the fellowship holder is given a vacation from June 15 to July 1. For the year 1935-36, problems of the following nature will be selected for investigation: 1. *Coal*. Problems in the treatment and utilization of coal and coke. 2. *Non-Metallics*. Problems in kaolin, talc, soapstone, silica sand, diatomite, and other non-metallics.

Arthur A. Denny Fellowship. To encourage graduate work a fellowship of \$500 annual value is open to students in the College of Mines who are residents of the State of Washington. It is awarded for scholastic excellence and general merit, but only to students who need financial assistance. Applications must be made to the dean of the college before March 15 preceding the academic year for which the fellowship is to be granted.

Investigations of Problems. Under certain conditions, the University will permit mining, metallurgical, and ceramic companies who have special problems for solution, to detail a representative to work on such problems, or to meet the expense of engaging a man to do so. Experiments which can be carried on as readily in commercial laboratories and which do not require direction from the college experts are not undertaken. The research is done under the direction of the department, and complete records of all the data obtained are filed with the department, which reserves the right to publish this information for the benefit of the mining, metallurgical and ceramic industries.

UNDERGRADUATE SCHOLARSHIPS

A scholarship of \$250, given by the late William Mackay of Roslyn, Washington, is available to junior and senior students in the College of Mines. The award is made on the basis of character, scholarship, and need of assistance. Applications are due in March.

Two scholarships amounting to \$170 each are awarded annually to upper-class students for services as assistants in the mining and metallurgy laboratories.

A scholarship based on the character, scholastic standing, and need of assistance of the student is offered by the Woman's Auxiliary of the American Institute of Mining and Metallurgical Engineers under the name of the Mary Young Westervelt scholarship. Applications for appointment for the following academic year are made in November to the North Pacific Section of the Woman's Auxiliary through the College of Mines.

MINES LOAN FUND

A loan fund, the nucleus of which was created by the North Pacific Section of the Woman's Auxiliary of the American Institute of Mining and Metallurgical Engineers, is available to assist upperclass students. Requests for financial assistance should be made to the dean of the college.

MINING INSTITUTE

Each winter, soon after the Christmas holidays, a Mining Institute is held for the benefit of prospectors, miners, metallurgists, mining investors, men engaged in the clay and cement industries, and all others interested. The instructors in the department of mining, metallurgy, and ceramic engineering demonstrate the extensive equipment in Mines Laboratory and perform tests of special interest to those enrolled in the Institute. Other members of the faculty of the College of Mines give lectures in their particular fields, and prominent mining engineers and operators give special talks on work in which they are engaged. In the evening lantern slides and moving pictures of the mining industry are shown. The course begins on a Monday morning and continues throughout the entire week. It is open to all persons and no fees are charged.

Announcement of the opening date is made in the local papers and in the technical press. It is not necessary to enroll in advance, but better preparation can be made if those who expect to attend will indicate their intention by phone or by letter to the College of Mines a few days before the date set for opening.

At the session held in January, 1935, the registered attendance numbered 280. The next session of the Institute will open at 9 a. m. on Monday morning, January 20, 1936.

MINES SOCIETY

The Mines Society, a student chapter of the American Institute of Mining and Metallurgical Engineers, has a membership composed of all students in the College. At the meetings of the society addresses are made by prominent mining engineers, and papers descriptive of their summer work are presented by the student members.

UNITED STATES BUREAU OF MINES NORTHWEST EXPERIMENT STATION

The Department of the Interior maintains at the College of Mines its Northwest Experiment Station, which serves the Pacific Northwest and the coast regions of Alaska. The headquarters of the station, from which all operations in this territory are directed, are in Mines Laboratory. At present the principal investigations being conducted by the station are in the treatment and uses of coal and of other non-metallic substances. These investigations are conducted by the Station in cooperation with the College of Mines principally through the research fellowships provided by the College. The results of cooperative investigations are published by the Bureau or the University.

Mine Safety Station. The Mine Safety Station of the United States Bureau of Mines is located in the new Federal Office Building on First Avenue at Madison Street. Apparatus for rescue and resuscitation is kept on hand for practice as well as for instant service. The senior safety instructor in charge of the Station gives instruction at Mines Laboratory to students in the College of Mines during the winter quarter. The applicant is taught the construction of the apparatus and is given practice in its use. First-aid instruction is also given. Applicants who have completed the course of training receive a certificate from the United States Bureau of Mines. An automobile truck equipped with rescue apparatus ready for emergency calls, forms part of the equipment of the Station.

EXPENSES

For information concerning University fees and expenses, see General Information bulletin.

REQUIREMENTS FOR ADMISSION

Correspondence. Credentials and all correspondence relating to admission to any college or school of the University should be addressed to the registrar, University of Washington. More detailed information concerning admission is contained in the General Information bulletin.

Credentials for students expecting to enter the University in the autumn quarter, 1935, should be filed in the registrar's office not later than August 15. Owing to the congestion of correspondence during the two weeks prior to the opening of each quarter, it is impossible to reply at once to letters and applications sent in during these periods. It is obligatory to submit at entrance, records from all schools previously attended.

Students are admitted to the resident work of the University by certificate or by examination. Only recommended graduates of fully accredited four-year secondary schools are admitted on certificate. The University reserves the right to reject any application for cause. Students are classified as graduates and undergraduates. Undergraduates are classified as regular students (freshmen, sophomores, juniors and seniors), unclassified students, and special students.

ADMISSION BY CERTIFICATE

A graduate of a four-year accredited secondary school, whose course has covered the requirements for entrance and who meets the scholarship requirement outlined below, will be admitted upon the presentation of satisfactory credentials. Since school diplomas do not give the necessary information, they cannot be accepted for this purpose. Principals of all accredited high schools in this state are furnished with the necessary official blanks for submitting student credentials. They may also be obtained from the registrar's office. Credentials accepted toward admission to the University are kept on permanent file.

No student may be accepted for admission who would not be recommended to the university of his home state.

A student graduating from a school system which provides for less than 12 years of instruction may be held for additional high school work.

ENTRANCE REQUIREMENTS

1. Graduation from an accredited high school or secondary school in the state of Washington.

2. Graduates of public accredited secondary schools from outside of Washington will be admitted on the same terms as graduates of the accredited secondary schools of this state, except that (a) no such graduates shall be admitted who would not be recommended to the university of his own state, and (b) no such graduate shall be admitted who is not eligible to enter the University as a regular student.

3. *Subject Requirements.* For entrance to the College of Mines the student must present twelve units* of credit, belonging normally to the 10th, 11th and 12th years of the high school curriculum, which must include the following:

English.....	two units*
Advanced algebra.....	one-half unit
Plane geometry.....	one unit
Solid geometry.....	one-half unit
Physics.....	one unit
Academic elective.....	one unit

*A "unit" is applied to work taken in the high school. To count as a unit, a subject must be taught five times a week, in periods of not less than forty-five minutes, for a school year of thirty-six weeks.

The additional six units may be chosen from either academic or non-academic subjects. A student who does not present high school chemistry for entrance will normally be expected to earn fifteen credits instead of twelve credits in chemistry during the freshman year. One unit of chemistry will be required, beginning in the autumn of 1936.

A student is advised not to attempt to enter the University until he is able to register in his chosen college without deficiencies. Under certain circumstances and with the approval of the dean of the college concerned, however, certain deficiencies in specific college requirements may be removed after entrance in the University.

Students in any college electing work in the Naval Reserve Officers' Training Corps are required to present plane geometry and plane trigonometry. For the naval course in aviation flight training (entered at the beginning of the senior year), in addition to the above, the student must have had elementary physics, solid geometry and college algebra. In most cases, plane trigonometry and college algebra, may be taken during the freshman year, but the student who is planning to apply for admission to the Naval R.O.T.C. should take physics, plane and solid geometry and advanced algebra while in high school.

4. *Scholarship Requirement.* Students entering with a grade point average of 2.0 or more during the last three years of high school enter as regular students. All other graduates of high schools satisfying the subject requirements as stated above will be admitted on freshman probation for one year. A student on freshman probation is excluded from student activities, fraternities and from any other non-academic work which, in the judgment of the dean, may interfere with his study program. Freshman probation also requires that the student confer with his dean at specified times in regard to his scholastic progress.

ADMISSION BY EXAMINATION

1. Certificate of successful examinations before the College Entrance Examination Board will be accepted. Students planning to enter the University by examination shall arrange their selection of subjects so that they will have no deficiencies for the college they elect, *i. e.*, the University College, College of Engineering, etc.

2. Students who have not graduated from high school and who do not plan to do so must enter by examination. All examinations will be given by the College Entrance Examination Board.

3. Definite information regarding the necessary examinations may be obtained from the registrar of the University. Applications for these examinations should be made to the College Entrance Examination Board, 431 West 117th Street, New York, N. Y.

ADMISSION TO ADVANCED STANDING

Applicants for advanced standing are required to furnish a complete official transcript of both preparatory and college credits, together with a letter of honorable dismissal from the institution last attended. (For information as to the scholarship required of transfer students, see the General Information bulletin.)

ACCREDITED SCHOOLS

The University of Washington depends on the State Board of Education for lists of accredited public and private high schools for the State of Washington.

SCHOOLS OUTSIDE OF WASHINGTON

Graduates of accredited high schools outside of Washington will be admitted as *regular students* on the same terms as graduates of the accredited high schools of Washington except that no such graduate shall be admitted who would not be *accepted* by the university of his own state. *The University will accept no students on probation from outside the state of Washington.* The University reserves the right to refuse admission to students from any school whose graduates have consistently failed to make satisfactory records in the University.

FOREIGN STUDENTS

Students from schools in foreign countries and non-English speaking communities will be admitted under the same general conditions as those from American schools, provided they have a sufficient working knowledge of English, acquaintance with American methods of instruction, and plans of study, to enable them to carry college work successfully. An examination will be required by the registrar on these supplementary points.

Students from foreign schools whose standing is not known to be the equivalent of accredited American schools may be required to pass College Entrance Board examinations in representative subjects.

PREPARATION IN ALGEBRA

All students entering any department of Engineering will be tested in high school algebra by class work and by an examination given shortly after the beginning of the first quarter. It is essential that students in the engineering courses shall possess a good working knowledge of algebra *at the beginning of their course*, and it is the purpose of the test to secure this by requiring a review of the subject shortly before entering the University. Students failing in the test are not permitted to continue with regular freshman engineering mathematics but are required to take a review of preparatory algebra (Math. 1, University College) during the first quarter.

DEGREES

The College of Mines offers specialized courses in mining, metallurgical, and ceramic engineering. The four-year curricula lead to degrees as follows:

- I. Bachelor of science in mining and metallurgy (B.S. in Min. and Met.)
- II. Bachelor of science in mining and geology (B.S. in Min. and Geol.)
- III. Bachelor of science in ceramic engineering (B.S. in Cer. E.)

Degree with Honors. A degree with honors in mines may be conferred upon any student of the College of Mines who, upon vote of the faculty and of the honors committee, may be declared worthy of unusual distinction.

Advanced Degrees. The degrees of master of science in mining, metallurgical, and ceramic engineering, respectively, will be conferred upon graduates of this college or of other engineering colleges of recognized standing, who complete in residence one year (45 credits) of prescribed graduate work including a thesis, with grades of A or B. The candidate must comply with the regulations of the Graduate School and pass a formal examination open to all members of the faculty. The selection of work for this degree must in each case be approved by the head of the department and by the Graduate Council.

The degree of engineer of mines (E.M.) may be granted to a graduate in mining engineering with a high scholarship record, who has practiced his profession for at least five years and who presents a satisfactory thesis prepared under the direction of the College of Mines. Similarly, graduates in metallurgy or in ceramics are eligible for the respective degrees of metallurgical engineer (Met.E.) or ceramic engineer (Cer.E.).

CURRICULA OF THE COLLEGE OF MINES

MINING, METALLURGICAL AND CERAMIC ENGINEERING

For the Freshman and Sophomore Years in All Options

FRESHMAN

<i>Autumn Quarter</i>	<i>Credits</i>	<i>Winter Quarter</i>	<i>Credits</i>	<i>Spring Quarter</i>	<i>Credits</i>
Chem. 24. General.....	4	Chem. 25. General.....	4	Chem. 26. General.....	4
G.E. 1. Drawing.....	3	G.E. 2. Drawing.....	3	G.E. 3. Drafting Probs..	3
G.E. 11. Engr. Prob.....	3	G.E. 12. Engr. Prob.....	3	G.E. 21. Surveying.....	3
Math. 31. Fresh. Engr.		Math 32. Fresh. Engr.		Math. 33. Fresh. Engr.	
Math.....	5	Math.....	5	Math.....	5
Military or Naval Sci.		Military or Naval Sci.		Military or Naval Sci.	
and Phys. Edu.....	+	and Phys. Edu.....	+	and Phys. Edu.....	+

SOPHOMORE

<i>Autumn Quarter</i>	<i>Credits</i>	<i>Winter Quarter</i>	<i>Credits</i>	<i>Spring Quarter</i>	<i>Credits</i>
Min. 51. Elem. of Min..	3	Min. 52. Methods.....	3	Met. 53. Elem. of Met..	3
Geol. 5. Rocks & Min..	5	Met. 153. Wet Assaying.	3	Cer. 90. Cer. Materials..	5
Math 41. Calc.....	3	Comp. 100.....	5	Geol. 121. Mineralogy..	5
Physics 97. Engineers'..	5	Physics 98. Engineers'..	5	Physics 99. Engineers'..	5
Military or Naval Sci.		Military or Naval Sci.		Military or Naval Sci.	
and Phys. Edu.....	+	and Phys. Edu.....	+	and Phys. Edu.....	+

Practice in mining or geology or metallurgy or ceramics in summer vacation.

MINING AND METALLURGY

Leading to the Degree of Bachelor of Science in Mining and Metallurgy.

JUNIOR

<i>Autumn Quarter</i>	<i>Credits</i>	<i>Winter Quarter</i>	<i>Credits</i>	<i>Spring Quarter</i>	<i>Credits</i>
Min. 101. Milling.....	3	Met. 103. Fuels.....	4	Min. 106. Mine Excur..	1
Met. 101. Fire Assaying.	3	E.E. 101-102. Dir. Cur..	6	Met. 102. Met. Lab....	2
Met. 104. Non-Ferrous..	3	Geol. 124. Petrography..	3	E.E. 121-122. Alt. Cur..	6
C.E. 91. Mechanics.....	3	C.E. 92. Mechanics.....	3	B.A. 3. Gen. Econ.....	3
Geol. 123. Optical Min..	3			Elective.....	3

Mining or metallurgical practice in summer vacation.

SENIOR

Min. 151. Min. Engr....	3	Min. 103. Mine Res. Tr..	1	Min. 107. Mine Excur..	1
Min. 191. Thesis.....	2	Min. 162. Costs.....	4	Min. 152. Ore Dress....	5
Met. 155. Iron & Steel..	3	Min. 192. Thesis.....	2	Min. 182. Min. Ind. Mgt.	3
Met. 162. Phys. Met....	3	Met. 163. Metallog.....	3	Min. 193. Thesis.....	1
Elective.....	4	Elective.....	4	Elective.....	4

Electives must in all cases be approved in advance by the head of the department.

For non-technical electives, see page 17.

MINING AND GEOLOGY

Leading to the Degree of Bachelor of Science in Mining and Geology.

FRESHMAN AND SOPHOMORE

(The same for all curricula. See above.)

JUNIOR

<i>Autumn Quarter</i>	<i>Credits</i>	<i>Winter Quarter</i>	<i>Credits</i>	<i>Spring Quarter</i>	<i>Credits</i>
Min. 101. Milling.....	3	Met. 103. Fuels.....	4	Min. 106. Mine Excur..	1
Met. 101. Fire Assaying.	3	Geol. 106. Physiog.....	5	Met. 102. Met. Lab....	2
Met. 104. Non-Ferrous..	3	Geol. 124. Petrography..	3	Geol. 107. Hist. Geol... 5	
Geol. 123. Optical Min..	3	C.E. 92. Mechanics.....	3	Geol. 125. Petrology....	3
C.E. 91. Mechanics.....	3			B.A. 3. Gen. Econ.....	3
				Elective.....	2

Mining or geology practice in summer vacation.

SENIOR

<i>Autumn Quarter</i>	<i>Credits</i>	<i>Winter Quarter</i>	<i>Credits</i>	<i>Spring Quarter</i>	<i>Credits</i>
Min. 151. Min. Engr....	3	Min. 103. Mine Res. Tr..	1	Min. 107. Mine Excur...	1
Min. 191. Thesis.....	2	Min. 162. Costs.....	4	Min. 152. Ore Dress....	5
Met. 162. Phys. Met....	3	Min. 192. Thesis.....	2	Min. 182. Min. Ind. Mgt.	3
Elective.....	6	Geol. 127. Econ. Geol. of Metals.....	5	Min. 193. Thesis.....	1
		Elective.....	3	Elective.....	4

Electives must in all cases be approved in advance by the head of the department.

For non-technical electives, see page 17.

CERAMIC ENGINEERING

Leading to the Degree of Bachelor of Science in Ceramic Engineering.

FRESHMAN AND SOPHOMORE

(The same for all curricula. See above.)

JUNIOR

<i>Autumn Quarter</i>	<i>Credits</i>	<i>Winter Quarter</i>	<i>Credits</i>	<i>Spring Quarter</i>	<i>Credits</i>
Min. 101. Milling.....	3	Met. 103. Fuels.....	4	Min. 106. Mine Excur...	1
Cer. 100. Plas., Susp. & Drying.....	3	Cer. 101. Firing.....	3	Met. 102. Met. Lab....	2
Cer. 104. Calc. for Bodies & Glazes....	3	Cer. 105. Calc. for Dry & Firing.....	3	Cer. 102. Cer. Decor....	3
C.E. 91. Mechanics....	3	C.E. 92. Mechanics....	3	Cer. 110. Cer. Meas....	3
Geol. 123. Optical Min..	3	Elective.....	3	B.A. 3	3
				Elective.....	3

Ceramics practice in summer vacation.

SENIOR

Min. 191. Thesis.....	3	Min. 103. Mine Res. Tr..	1	Min. 107. Mine Excur...	1
Met. 162. Phys. Met....	3	Min. 192. Thesis.....	3	Min. 193. Thesis.....	2
Cer. 121. Cer. Prod. Lab.	5	Cer. 122. Cer. Prod. Lab.	5	Cer. 123. Cer. Prod. Lab.	5
Chem. 181. Phys.&Theor.	3	Chem. 182. Phys.&Theor.	3	Elective.....	6
		Elective.....	3		

Suggested electives for students especially interested in

Mining Engineering: Min. 171; M.E. 81, 82, 83.

Coal Mining: Min. 122, 171, 176; M.E. 81, 82, 83.

Metallurgy: Met. 165, 166.

Ceramics: Cer. 131, 132, 133; Min. 152; Geol. 124, 125, 128; Physics 109.

General electives: Comp. 102, Speech 103, modern foreign language, B.A. 54.

Electives must in all cases be approved in advance by the head of the department.

COURSES OF STUDY

MINING

51. *Elements of Mining.* The field of mining, considering prospecting and boring, drilling, explosives, rock breaking, and principles applying to open-pit and underground methods. Prerequisite, sophomore standing. Three recitations. Three credits; autumn. Daniels.

52. *Methods of Mining.* Continuation of Min. 51. Methods of working metal, coal, and placer mines, quarries, and clay deposits. Prerequisite, Min. 51. Two recitations and one laboratory period. Three credits; winter. Daniels.

101. *Milling.* Preliminary course in the principles of ore dressing; practice with all milling machinery in Mines Laboratory. Prerequisite, junior standing. Two recitations and one laboratory period. Three credits; autumn. Roberts.

103. *Mine Rescue Training.* Practice in the use of oxygen rescue apparatus, and instruction in first-aid; 25 hours' intensive instruction during first three weeks of quarter. Physical examination required. A government certificate is granted on completion of course. One credit; winter. Daniels.

106. *Mine Excursion*. A five-days' trip in spring of junior year to a neighboring mining region; detailed inspection of mines. Expense approximately \$25. One credit; spring. Roberts, Daniels.

107. *Mine Excursion*. A five-days' trip in spring of senior year, similar to Min. 106. One credit; spring. Roberts, Daniels.

122. *Coal Mining Methods*. Special methods involved in prospecting, development, and operation of coal and stratified deposits. Detailed studies are made at nearby mines. Prerequisite, Min. 51 and Min. 52. Three recitations. Three credits; winter. Daniels.

151. *Mining Engineering*. Principles and practice as exemplified at typical mines. Laboratory studies of air compressors, drills, etc.; studies at nearby mines. Prerequisite, senior standing. Two recitations, one laboratory period. Three credits; autumn. Roberts.

152. *Ore Dressing*. The principal branches of ore dressing, with laboratory practice in complete mill tests. Prerequisite, senior standing. Three recitations and two laboratory periods. Five credits; spring. Roberts.

162. *Costs in the Mineral Industry*. An economic study of the whole cost of producing and selling metals and non-metallic mineral products. Open to seniors in any department. Three recitations and one laboratory period. Four credits; winter. Roberts.

*163. *Mine Operation*.

171. *Mine Ventilation*. Composition and properties of mine gases; principles of ventilation; safety and physiological factors applied to both coal and metal mines. Prerequisites, Min. 51, 52, and 103. Three recitations. Three credits; winter. Daniels

176. *Coal Preparation*. Methods of preparing coal by dry and wet cleaning processes; control by float-and-sink methods. Field examinations of washing plants at local mines. Prerequisites, Min. 101, and Met. 103. Two recitations and two four-hour laboratory periods. Five credits; winter. Daniels.

182. *Mineral Industry Management*. Employment of labor, systems of payment, efficiency of labor and methods, social and economic aspects of mineral engineering operations. Prerequisite, senior standing. Three recitations. Three credits; spring. Daniels.

191, 192, 193, 194. *Thesis*. Preparation of a graduation thesis in mining, metallurgy, or ceramics. Completed thesis is due one month before graduation. Prerequisite, senior standing. A minimum total of five credits allowed for thesis. Hours and credits to be arranged; autumn, winter, spring, summer.

Roberts, Daniels, Corey, Wilson.

COURSES FOR GRADUATES ONLY

201, 202, 203. *Seminar*. Lectures and discussions by Bureau of Mines staff, mining engineering faculty and fellows. Required of fellowship holders in the College of Mines. Prerequisite, graduate standing. One credit; autumn, winter, spring. Staff.

211, 212, 213, 214. *Graduate Thesis*. Preparation of a thesis in mining, metallurgy, or ceramics. Prerequisite, graduate standing. Completed thesis is due at least one month before graduation. Hours and credits to be arranged; total nine credits allowed for thesis. Autumn, winter, spring, summer.

Roberts, Daniels, Corey, Wilson.

*Not offered in 1935-36.

221, 222, 223. *Metal Mining*. Studies in metal mining. Prerequisite, graduate standing. Hours and credits to be arranged. Roberts.

231, 232, 233. *Ore Dressing*. Studies in ore dressing. Prerequisite, graduate standing. Hours and credits to be arranged. Roberts.

251, 252, 253. *Coal Mining*. Studies in coal mining or in the preparation of coal. Prerequisite, graduate standing. Hours and credits to be arranged. Daniels.

261, 262, 263. *Fuels and Combustion*. A course in fuels, their utilization and combustion. Prerequisite, graduate standing. Hours and credits to be arranged. Daniels.

271. *Cooperative Research with U. S. Bureau of Mines*. Investigations by holders of cooperative fellowships in College of Mines and Northwest Experiment Station. Six credits; autumn. Staff.

METALLURGY

53. *Elements of Metallurgy*. Properties of metals and alloys, fuels, refractory materials, furnaces, the extraction of the common metals from their ores. Open to all engineering students with sophomore standing. Prerequisite, Chem. 26. Three recitations. Three credits; spring. Corey.

101. *Fire Assaying*. Testing of reagents, crushing, sampling, and assaying of ores, furnace, and mill products. Prerequisite, Chem. 26. One recitation and two laboratory periods. Three credits; autumn. Corey.

102. *Metallurgical Laboratory*. Experiments illustrating metallurgical principles. Prerequisite, Met. 53. One four-hour laboratory period. Two credits; spring. Corey.

103. *Fuels*. Primary and manufactured fuels; source, composition, methods of utilization, economy, relative values, and efficiencies. Laboratory work in analysis of common fuels. Prerequisite, junior standing. Three recitations and one laboratory period. Four credits; winter. Daniels, Corey.

104. *Non-ferrous Metallurgy*. Metallurgy of copper, lead, zinc, gold and silver, especially the methods of roasting, smelting, lixiviation and refining. Prerequisite, Met. 53. Three recitations. Three credits; autumn. Corey.

140. *Materials of Construction*. Methods of manufacture, properties, and engineering uses of ferrous and non-ferrous metals and alloys, and ceramic materials. Prerequisite, junior standing. Three lectures. Three credits; autumn. Corey, Daniels, Wilson.

153. *Wet Assaying*. Technical methods for the determination of copper, lead, zinc, etc., in ores and furnace products. Prerequisite, Chem. 26. One recitation and two laboratory periods. Three credits; winter. Corey.

155. *Iron and Steel*. Metallurgy and manufacture of commercial iron and steel; especially, their properties and uses in engineering work. Prerequisite, junior standing. Three recitations. Three credits; autumn. Daniels.

160. *Metallurgical Analysis*. Technical methods of analysis of slags, industrial products and (for ceramics and geology students) clays and rocks. Prerequisite, Met. 153. Two laboratory periods. Two credits; spring. Corey.

162. *Physical Metallurgy*. The constitution of metals and alloys, and their relations to the physical and mechanical properties of the metal. Prerequisite, senior standing. Open to all upperclass engineering students. Three recitations. Three credits; autumn. Corey.

163. *Metallography*. Preparation and study of metal sections, photomicrography and the use of the microscope in testing industrial alloys. One recitation and two laboratory periods. Open to all upperclass engineering students. Three credits; winter. Corey.

165. *Metallurgical Calculations*. Physical chemistry of the metallurgist, slag calculations, and furnace problems. Prerequisite, junior standing. Three recitations. Three credits; winter. Corey.

166. *Advanced Non-ferrous Metallurgy*. Study of methods and practice in the extraction of the minor non-ferrous metals. Prerequisite, senior or graduate standing. Three credits; spring. Corey.

COURSES FOR GRADUATES ONLY

221, 222, 223. *Advanced Metallurgy*. Studies in metallurgy. Prerequisite, graduate standing. Hours and credits to be arranged. Corey.

CERAMICS

90. *Ceramic Materials*. Origin, occurrence, physical properties, and preparation of materials used in the ceramic and non-metallic industries. Prerequisite, sophomore standing in mines, engineering, or science. Three recitations. Three credits; spring. Wilson.

100. *Plasticity, Suspensions and Drying*. Physical characteristics of ceramic materials in the plastic condition and as slip-suspensions. Prerequisite, Cer. 90. Three recitations. Three credits; autumn. Wilson.

101. *Firing*. The effect of heat on ceramic materials; vitrification of clay; melting, fusion, and crystallization of silicates. Prerequisite, Cer. 100. Three recitations. Three credits; winter. Wilson.

102. *Ceramic Decoration*. The value of decoration in ceramics. Ceramic colors, surface textures and glazes. The chemistry of color production. Prerequisite, Cer. 101. Three recitations. Three to six credits; spring. Wilson.

104. *Calculations for Bodies and Glazes*. Physics and chemistry of preparing, drying, firing, testing and designing ceramic materials and glazes. Prerequisite, junior standing in mines or engineering. Three recitations. Three credits; autumn. Wilson.

105. *Calculations for Drying and Firing*. Problems in the physics and chemistry of drying, firing, and the combustion of fuel. Prerequisite, junior standing in mines or engineering. Three recitations. Three credits; winter. Wilson.

110. *Ceramic Physical-Chemical Measurements*. Laboratory testing of clays and other ceramic materials. Prerequisite, junior standing in mines or engineering. Two laboratory periods. Two credits; spring. Wilson.

121, 122, 123. *Ceramic Products Laboratory*. Laboratory problems in preparing raw materials and the manufacture and testing of ceramic and non-metallic products. Prerequisite, Cer. 90 to 110. Three laboratory periods and two recitations. Five credits a quarter; autumn, winter, spring. Wilson.

**131, 132, 133. *General Ceramics*. Technology of pottery, glass, lime plaster, cements, metal enamels, or refractories. Hours and credits to be arranged. Wilson.

COURSES FOR GRADUATES ONLY

221, 222, 223. *Ceramic Research*. Studies of the ceramic resources of the Pacific Northwest or in the development of new products or processes. Prerequisite, graduate standing. Hours and credits to be arranged. Wilson.

**Will be offered if a sufficient number of students elect the course.

REQUIRED SUBJECTS GIVEN BY OTHER COLLEGES IN THE UNIVERSITY

Chemistry

- 24-25, 26. General Chemistry. Five credits a quarter; autumn, winter, spring.
181, 182, 183. Physical Chemistry. Five credits a quarter; autumn, winter, spring.

Economics

3. General Economics. Three credits; any quarter.

Engineering, General

- 1, 2, 3. Engineering Drawing. Three credits a quarter; any quarter.
11, 12. Engineering Problems. Three credits a quarter; any quarter.
21. Plane Surveying. Three credits; any quarter.

Engineering, Civil

- 91, 92. Mechanics. Three credits; any quarter.

Engineering, Electrical

- 101, 102. Direct Currents. Four credits; any quarter; laboratory, two credits; any quarter.
121, 122. Alternating Currents. Four credits; any quarter; laboratory, two credits; any quarter.

English

Composition

- B. Elementary composition for students in engineering and mining. A non-credit course for students who need additional preparation before entering Comp. 100; autumn, winter, spring.
100. Technical Composition. Three credits; any quarter.

Geology

5. Rocks and Minerals. Five credits; autumn.
106. Principles of Physiography. Five credits; winter.
107. Principles of Historical Geology. Five credits; spring.
121. Mineralogy. Five credits; spring.
123. Optical Mineralogy. Three credits; autumn.
124. Petrography. Three or five credits; winter.
125. Petrology. Three or five credits; spring.
127. Ore Deposits. Five credits; winter.

Mathematics

- 31, 32, 33. Engineering Freshman Mathematics. Four credits; each quarter.
41, 42. Calculus. Three credits a quarter; autumn, winter, spring.

Military Science and Tactics or Naval Science and Physical Education

- A course of two years in military or navel science and physical education is required. See Rules 17, 18, 19, in General Information bulletin.

Physics

- 97, 98, 99. Physics for Engineers. Five credits; any quarter.

Description of these courses, with all those offered in any school or college of the University, will be found in the section of the catalogue known as Departments of Instruction (also published separately).

ELECTIVES

Astronomy

1. Astronomy. Five credits; autumn, spring.

Economics

- 54, 55, 56. Business Law. Three credits, autumn, winter, spring.
- 62, 63. Principles of Accounting. Five credits; autumn, winter, spring.
121. Corporation Finance. Five credits; autumn, winter.
122. Principles of Investment. Five credits; winter, spring.

Engineering, Mechanical

- 53, 54, 55. Metalwork. One credit a quarter; autumn, winter, spring.

Engineering, Civil

142. Hydraulics. Five credits; spring.

English

Composition

102. English for Engineers. Three credits; autumn, winter, spring.

Literature

- 64, 65. Literary Backgrounds. Five credits; autumn, winter, spring.
73. Introduction to Modern Literature. Five credits; autumn, winter, spring.
- 97, 98, 99. The Bible as Literature. Two credits; autumn, winter, spring.
- 104, 106. Contemporary Literature. Three credits; autumn, winter, spring.
- 141, 142, 143. Social Ideals in Literature. Three credits; autumn, winter, spring.
- 164, 165, 166. American Literature since 1870. Three credits; autumn, winter, spring.

Speech

40. Essentials of Speaking. Five credits; autumn, winter, spring.
43. The Speaking Voice. Three credits; autumn, winter, spring.
103. Extemporaneous Speaking. Three credits; spring.

French

- 4, 5, 6. Modern Texts. Prerequisite, two years of French in high school or equivalent. Three credits; autumn, winter, spring.
- 137, 138, 139. Scientific French. Prerequisite, French 6 or equivalent. Two credits; autumn, winter, spring.

Geology

128. Mineral Resources—Non-Metals. Three credits; spring.

Geography

70. Conservation of Natural Resources. A public policy course in the handling of forests, minerals, fisheries, public lands, soil, etc. Includes reclamation, drainage, irrigation. (Upper or lower division credit.) Five credits; winter. Martin.
102. Geography of North America. Five credits; autumn.

German

5. Second Year Reading. Prerequisite, two years in high school or equivalent. Three credits; autumn, winter, spring.
- 60, 61. Lower Division Scientific German. Three credits; autumn, winter, spring.

History

- 5, 6. English Political and Social History. Five credits; autumn, winter.
- 10. The Agrarian Crusade in the U. S., 1860-1934. Three credits; spring.
- 60, 61, 62. Makers of the Nation. Two credits; autumn, winter, spring.
- 143, 144, 145. History of the United States. Three credits; autumn, winter, spring.
- 149. History of National Development. Five credits; spring.
- 153. The Pacific Rim. Three credits; autumn.

Liberal Arts

- 1. Introduction to Modern Thought. Five credits; autumn, spring.
- 11. Introduction to the Study of the Fine Arts. Five credits; winter, summer.

Modern Language

For description of courses in modern languages see the statements of the modern language department in the Departments of Instruction bulletin.

Music

- 22, 23, 24. Music Appreciation (for non-music majors). Two credits; autumn, winter, spring.

Philosophy

- 1. Introduction to Philosophy. Five credits; autumn, winter, spring.
- 2. Introduction to Social Ethics. Five credits; winter.
- 5. Introduction to Logic. Five credits; autumn, winter.

Physics

- 101-102. Introduction to Modern Theories. Five credits; autumn, winter.
- 109. Pyrometry. Three credits; spring. Utterback.
- 115. Applications of Photography to Scientific Work. Three credits; winter.

Physiology

- 53. Intermediate Physiology. Five credits; autumn.
- 54. Intermediate Physiology. Five credits; winter.

Political Science

- 111. History of Political Theory. Five credits; autumn.
- 112. American Political Theory. Three credits; winter.
- 113. Contemporary Political Thought. Five credits; spring.
- 121. Foreign Relations of the United States-Europe. Three credits; winter.
- 122. The Foreign Service. Three credits; spring.
- 127. International Organization and Administration. Five credits; winter.
- 155. Introduction to Public Administration. Five credits; autumn.
- 156. European Governments. Five credits; spring.
- 162. Municipal Administration. Five credits; autumn.

Psychology

- 1. General Psychology. Five credits; autumn, winter, spring.
- 121. Applied Psychology. Five credits; winter.

Sociology

- 1. Introductory Sociology. Five credits; autumn, winter, spring.
- 140. Population. Three credits; autumn.
- 150. General Sociology. Five credits; autumn.

Zoology

- 16. Evolution. Two credits; autumn.
- 17. Eugenics. Two credits; winter, spring.

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UNIVERSITY PUBLICATIONS

The University of Washington Bulletin (general series) includes the general catalogue, bulletins of the colleges and schools, University Directory (price 50 cents), Extension Service, General Information, Oceanographic Laboratories, Summer Quarter, Time Schedule, Vocational (price 50 cents). The general catalogue is limited to exchange purposes; the college bulletins are distributed without charge.

The following series are published at irregular intervals and are sold for stated charges. Persons wishing to obtain any of these publications are requested to correspond with the publications editor. Libraries or institutions offering material of equivalent value may secure exchanges by corresponding with the University librarian.

The University of Washington Publications contain the results of research work in various departments of the University. These publications include the following series: Anthropology, Biology, Geology, Language and Literature, Mathematics and the Social Sciences.

The Publications of the Engineering Experiment Station include bulletins of information and investigation concerning engineering and scientific problems.

The Publications in Oceanography are based on the investigational work carried on at the Friday Harbor Station, as well as on the University of Washington campus.

The Extension Service Series includes monographs of interest and value to the layman. While authentic, they are not written in highly technical terms with which the general public is unfamiliar.

HARRIETT WESTMORELAND, *Publications Editor*

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BULLETIN
UNIVERSITY OF WASHINGTON

GENERAL SERIES

JUNE 12, 1937

No. 480

COLLEGE OF MINES

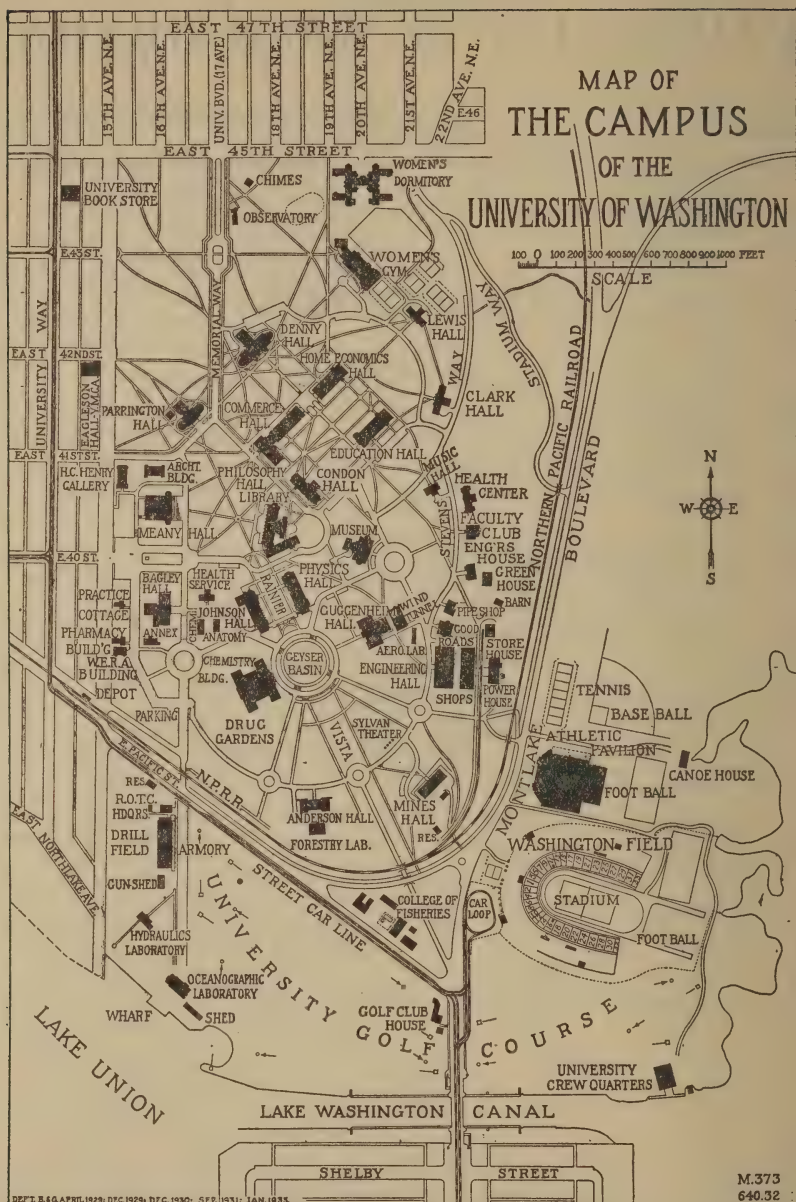
1937-1938

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UNIVERSITY OF MINES



SEATTLE, WASHINGTON

Published weekly at Seattle, Washington, by the University of Washington from October to July, inclusive. No issues in August and September. Entered as second-class matter at Seattle, Washington, under the Act of August 24, 1912.



The University campus, comprising 582 acres, lies between Fifteenth Avenue North-east and Lake Washington, and East Forty-fifth Street and Lake Union. Ravenna and Cowen Park cars run one block west of the campus. The offices of administration are located in Education Hall and are best reached by leaving the car at East Forty-second Street and University Way.

THE UNIVERSITY CALENDAR

1937-1938

AUTUMN QUARTER

Pre-registration dates.....May 3 to May 28, inclusive
Section reservations of pre-registered students will be cancelled if tuition
is not paid by.....Friday, September 10
Registration dates for students (not Engineers) who do not pre-register

August 2 to September 29, inclusive

During this period, fees must be paid in advance of registration.

Students may not register from May 29 to August 1.

Registration dates for Engineers who do not pre-register....Sept. 2 to Sept. 29, inclusive
During this period, fees must be paid in advance of registration.

Last registration day before beginning of instruction.....Wednesday, September 29

Special Instruction for New Freshmen.....Begins 9 a.m., Sept. 30; ends Oct. 2

College Aptitude Test (Room 233 Philosophy Hall).....Oct. 2, 8 a.m.

Instruction begins.....Monday, October 4

President's annual address.....Friday, October 8, 11 a.m.

Last day to register with late fee, and to add a course.....Saturday, October 9, 12 m.

Regular meeting of the faculty.....Tuesday, October 26, 4 p.m.

Last day to withdraw and receive a "W" without grade....Saturday, November 13, 12 m.

President's Reception to Parents of New Freshmen.....Tuesday, November 23, 7:30 p.m.

Thanksgiving recess begins.....Wednesday, November 24, 6 p.m.

Thanksgiving recess ends.....Monday, November 29, 8 a.m.

Regular meeting of the faculty.....Tuesday, December 7, 4 p.m.

Instruction ends.....Friday, December 17, 6 p.m.

WINTER QUARTER

Pre-registration dates.....November 1 to December 17, inclusive
Section reservations of pre-registered students will be cancelled if tuition
is not paid by.....Friday, December 17

Registration dates for students who do not pre-register.....Dec. 27 to Dec. 31, inclusive
During this period fees must be paid in advance of registration.

Students may not register from December 18 to December 26.

Last registration day before the beginning of instruction.....Friday, December 31

Instruction begins.....Monday, January 3, 8 a.m.

Last day to register with late fee and to add a course.....Saturday, January 8, 12 m.

College Aptitude Test (233 Philos. Hall)....Mon., Jan. 10, 12 m. or Tues., Jan. 11, 8 a.m.

Regular meeting of the faculty.....Tuesday, January 25, 4 p.m.

Last day to withdraw and receive a "W" without grade.....February 12, 12 m.

Washington's birthday, (Founders' Day).....Tuesday, February 22

Regular meeting of the faculty.....Tuesday, March 8, 4 p.m.

Instruction ends.....Friday, March 18, 6 p.m.

SPRING QUARTER

Pre-registration dates.....February 1 to March 18, inclusive
Section reservations of pre-registered students will be cancelled if tuition
is not paid by.....Friday, March 18

Registration dates for students who do not pre-register....March 23 to March 26, 12 m.
During this period, fees must be paid in advance of registration.

Students may not register from March 19 to March 22.

Last registration day before beginning of instruction.....Saturday, March 26, 12 m.

Instruction begins.....Monday, March 28, 8 a.m.

Last day to register with late fee, and to add a course.....Saturday, April 2, 12 m.

College Aptitude Test (233 Philos. Hall)....Mon., Apr. 4, 12 m. or Tues., Apr. 5, 8 a.m.

Regular meeting of the faculty.....Tuesday, April 19, 4 p.m.

Last day to withdraw and receive a "W" without grade.....Saturday, May 7, 12 m.

Governor's Day.....Thursday, May 19

Memorial Day (holiday).....Monday, May 30

Regular meeting of the faculty.....Tuesday, May 31, 4 p.m.

Instruction ends.....Friday, June 10, 6 p.m.

Class Day and Alumni Day.....Saturday, June 11

Baccalaureate Sunday.....Sunday, June 12

Commencement.....Monday, June 13

SUMMER QUARTER**1938**

Pre-registration dates.....	April 25 to June 11, 12 m.
Last day for securing reserved sections by payment of fees for students who pre-register (1st term).....	Saturday, June 11, 12 m.
Last registration day before beginning of instruction.....	Tuesday, June 14
On this day, fees must be paid when the student registers.	
Instruction begins.....	Wednesday, June 15, 8 a.m.
Last day to add a course (1st term).....	Friday, June 17
Last day to add a course (full quarter).....	Tuesday, June 21
College Aptitude Test (Room 233 Philosophy Hall).....	Monday, June 27, 12 m.
Independence Day (holiday).....	Monday, July 4
Last day to withdraw and receive a "W" without grade (1st term) Tues.,	July 5, 4:30 p.m.
First term ends.....	Friday, July 22, 6 p.m.
Last day for securing reserved sections by payment of fees (2nd term).....	Fri., July 22
Last day to withdraw and receive a "W" without grade (full quarter)	Friday, July 22, 4:30 p.m.
Last registration day before beginning of instruction (2nd term).....	Saturday, July 23, 12 m.
On this day, fees must be paid when the student registers.	
Second term begins.....	Monday, July 25, 8 a.m.
Last day to add a course (2nd term).....	Wednesday, July 27
College Aptitude Test (Room 233 Philosophy Hall).....	Monday, August 1, 12 m.
Last day to withdraw and receive a "W" without grade (2nd term) Tues.,	Aug. 9, 4:30 p.m.
Instruction ends.....	Thursday, August 25, 6 p.m.

NOTICE

The University and its various colleges and schools reserve the right to change the rules regulating admission to, instruction in and graduation from the University and its various divisions and any other regulations affecting the student body. Such regulations shall go into force whenever the proper authorities may determine, and shall apply not only to prospective students, but also to those who may, at such time be matriculated in the University. The University also reserves the right to withdraw courses or change fees at any time.

COLLEGE OF MINES

ADMINISTRATIVE OFFICERS

Lee Paul Sieg, Ph.D., LL.D.....*President of the University*
 Milnor Roberts, B.A.....*Professor of Mining and Metallurgical Engineering;*
Dean of the College of Mines

THE FACULTY, 1937-1938

Joseph Daniels, M.S., E.M.....*Professor of Mining and Metallurgical Engineering*
 Hewitt Wilson, Cer.E.....*Professor of Ceramic Engineering*
 Clarence Raymond Corey, E.M., M.A.....*Associate Professor of Mining and Metallurgical Engineering*

The faculty also includes a representative from each of the ten other departments that give instruction to Mines students.

ADVISORY BOARD OF COLLEGE OF MINES

University of Washington

Roy H. Clarke.....*Mining Engineering, President Northwest Mining Association, Spokane*
 A. B. Fosseen.....*Washington Brick, Lime, and Sewer Pipe Company, Spokane*
 John T. Heffernan.....*Mine Operator, President Glacier Gravel Company, Seattle*
 E. P. Lucas.....*President Bellingham Coal Mines, Seaboard Building, Seattle*
 Nathaniel D. Moore.....*President Pacific Coast Coal Company, Seattle*
 Raymond R. Smith.....*Vice President and Northern Manager, Gladding, McBean & Company, 1500 First Avenue South, Seattle*
 Livingston Wernecke.....*Mining Engineer, Manager Treadwell Yukon Company, Wernecke, Yukon, Canada*
 Eugene A. White.....*Metallurgist, Manager Tacoma Smelter, Tacoma*

STAFF OF NORTHWEST EXPERIMENT STATION

United States Bureau of Mines, Department of the Interior

Harry Fagan Yancey, Ph.D. (Illinois).....*Supervising Engineer*
 Kenneth A. Johnson, B.S. (Washington).....*Junior Chemist*
 Henry T. Keating.....*Principal Clerk*
 Max R. Geer, M.S. (Washington).....*Scientific Aid, Mining*
 Kenneth G. Skinner, M.S. (Washington).....*Scientific Aid, Ceramics*
 Rudolph E. Zane, M.S. (Washington).....*Assistant Analytical Chemist*
 Anthony D. Centenero, B.S. (Washington).....*Assistant Analytical Chemist*
 William E. Lance.....*Mill Mechanic*
 James Westfield, Jr.....*Senior Safety Instructor, Mine Safety Station*

SCOPE AND FACILITIES

Mining, Metallurgical, and Ceramic Industries Available for Study.
 Mining machinery of many kinds is in operation within easy reach of the University. It is also kept in stock at the Seattle branches of the eastern machinery firms, for distribution throughout the Pacific Northwest, British Columbia, and Alaska. Methods important to the mining engineer are illustrated in Seattle by the operations of steam shovels and hydraulic giants. Engineers in charge of mines and plants have given students every opportunity to become familiar with the methods of planning and carrying on work.

Available works of interest include coal mines, washeries, briquet plants, and coke ovens, with the largest production west of the Rocky Mountain region; gold, silver, copper, arsenic, manganese, and mercury mines, and treatment plants; cement plants, stone quarries, and dressing works; clay mines, and works producing brick, building and roof tile, terra cotta, sewer pipe and drain tile, fire brick, pottery, and decorated mantel tile; sand and gravel pits making large production by modern methods; the Tacoma smelter and refinery; the U. S. Assay Office; the Northwest Lead works; the Seattle steel plant of the Pacific Coast Steel Corporation, numerous foundries, and plants engaged in electro-metallurgy.

Laboratories

The headquarters of the College of Mines are in Mines Laboratory, a steel-frame building, which has an area of 57 by 162 feet and a height of 58 feet, with four full floors and mezzanine decks. The building, in addition to the laboratories, contains the offices, classrooms, and library of the departments of mining, metallurgical, and ceramic engineering, and the offices of the Northwest Experiment Station of the United States Bureau of Mines, which makes joint use of the College of Mines equipment.

Complete equipment is available for carrying on laboratory instruction, technical investigations and tests, and research studies. The cost of the building and equipment to date has exceeded one-third of a million dollars.

Mining. The mining equipment is divided into three groups, as follows: exhibits designed for purposes of study, laboratory apparatus for experiment and practice, and field equipment.

Mineral Dressing. The laboratory was designed for testing not only ores but also non-metallic mineral substances, which are of great importance in Washington and the Northwest. The equipment is new and complete; much of it is of standard size.

Metallurgy. Separate laboratories are provided for general metallurgy, fire assaying, wet analysis, fuels, electrolytic work, research, and metallography, besides the balance rooms, dark room, and stock room.

Coal Washing. The coal section of Mines Laboratory occupies an area of 54 by 57 feet and a height of 70 feet, including four stories and a sub-basement, connected by electric elevator. Full-size equipment is provided for receiving and storing a carlot of coal, followed by picking, elevating, screening, jigging, classifying, tabling, and air-tabling. This portion of the building also contains fuel and analytical laboratories for the College of Mines and the U. S. Bureau of Mines, a room for conducting float-and-sink tests, a sampling room, and a coal-crushing and grinding room for the preparation of samples.

Ceramics. The ceramics apparatus is used for washing, purifying and preparing ceramic and non-metallic raw materials, and for the manufacture and testing of finished ceramic products.

Mining, Metallurgical, and Ceramic Research

The College aims to encourage development in the mining, metallurgical and ceramic industries of Washington, the Pacific Northwest and Alaska by research in the special problems presented, and to solve the problems through the efforts of fellowship holders and others studying in the College.

Graduates from suitable technical courses at institutions of recognized standing, or men who present evidence of technical training that has fitted them to undertake investigations, are eligible to enroll in mining and metallurgical research. The degree of master of science may be granted students holding suitable bachelor of science degrees who complete investigative work in compliance with the University requirements for the master's degree. Although as much latitude as possible will be allowed in the choice of subjects for research, the general topics will be those of special importance to this region.

Research Fellowships. The College of Mines offers four fellowships for research in coal and other non-metallic mineral substances, in cooperation with the United States Bureau of Mines. The fellowships are open to graduates of universities and technical colleges who are properly qualified to undertake research investigations. The value of each fellowship is about \$720

to the holder, for the 12 months beginning July 1. Fellowship holders register as graduate students and become candidates for the degree of master of science in the proper subject, unless an equivalent degree has been earned previously.

Each applicant should send a copy of his collegiate record from the registrar of the college where he has graduated, or will graduate in June. He should also send a photograph and a detailed statement of his professional experience, if any, and give the names and addresses of at least three persons who are familiar with his character, training, and ability. Applications should be submitted by April 1, and should be addressed to the Dean, College of Mines, University of Washington, Seattle, Washington.

Appointees to the fellowship report for duty on July 1, and are required to be on duty for a full year, except that in case of reappointment for a second year, the fellowship holder is given a vacation from June 15 to July 1. For the year, 1937-1938, problems of the following nature will be selected for investigation: 1. *Coal*. Problems in the treatment and utilization of coal and coke. 2. *Non-metallics*. Problems in kaolin, talc, soapstone, silica, sand, diatomite, and other non-metallics.

*Arthur A. Denny Fellowship.** To encourage graduate work, a fellowship of \$500 annual value is open to students in the College of Mines who are residents of the State of Washington. It is awarded for scholastic excellence and general merit, but only to students who need financial assistance. Applications must be made to the dean of the college before March 15 preceding the academic year for which the fellowship is to be granted.

Investigations of Problems. Under certain conditions, the University will permit mining, metallurgical, and ceramic companies who have special problems for solution, to detail a representative to work on such problems, or to meet the expense of engaging a man to do so. Experiments which can be carried on as readily in commercial laboratories and which do not require direction from the college experts are not undertaken. The research is done under the direction of the College, and complete records of all the data obtained are filed with the College, which reserves the right to publish this information for the benefit of the mining, metallurgical and ceramic industries.

Undergraduate Scholarships

A scholarship of \$250, given by the late William Mackay of Roslyn, Washington, is available to junior and senior students in the College of Mines. The award is made on the basis of character, scholarship, and need of assistance. Applications are due in March.

Two scholarships amounting to \$180 each are awarded annually to upperclass students for services as assistants in the mining and metallurgy laboratories.

A scholarship based on the character, scholastic standing, and need of assistance of the student is offered by the Woman's Auxiliary of the American Institute of Mining and Metallurgical Engineers under the name of the Mary Young Westervelt scholarship. Applications for appointment for the following academic year are made in November, through the College of Mines, to the North Pacific Section of the Woman's Auxiliary.

Mines Loan Fund

A loan fund, the nucleus of which was created by the North Pacific Section of the Woman's Auxiliary of the American Institute of Mining and Metallurgical Engineers, is available to assist upperclass students. Requests for financial assistance should be made to the dean of the college.

*Not available in 1937-1938.

Mining Institute

Each winter, soon after the Christmas holidays, a Mining Institute is held for the benefit of prospectors, miners, metallurgists, mining investors, men engaged in the clay and cement industries, and all others interested. The instructors in the department of mining, metallurgy, and ceramic engineering demonstrate the extensive equipment in Mines Laboratory and perform tests of special interest to those enrolled in the Institute. Other members of the faculty of the College of Mines give lectures in their particular fields, and prominent mining engineers and operators give special talks on work in which they are engaged; lantern slides and moving pictures of the mining industry are shown. The course begins on a Monday morning and continues throughout the entire week. It is open to all persons and no fees are charged.

Announcement of the opening date is made in the local papers and in the technical press. It is not necessary to enroll in advance, but better preparation can be made if those who expect to attend will indicate their intention by phone or by letter to the College of Mines a few days before the date set for opening.

At the session held in January, 1937, the registered attendance numbered 284. The next session of the Institute will open at 9 a.m. on Monday morning, January 17, 1938.

Mines Society

The Mines Society, a student chapter of the American Institute of Mining and Metallurgical Engineers, has a membership composed of all students in the College. At the meetings of the society addresses are made by prominent mining engineers and papers descriptive of their summer work are presented by the student members.

United States Bureau of Mines Northwest Experiment Station

The Department of the Interior maintains at the College of Mines its Northwest Experiment Station, which serves the Pacific Northwest and the coast regions of Alaska. The headquarters of the Station, from which all operations in this territory are directed, are in Mines Laboratory. At present the principal investigations being conducted by the station are in the treatment and uses of coal and of other non-metallic substances. These investigations are conducted by the Station in cooperation with the College of Mines principally through the research fellowships provided by the College. The results of cooperative investigations are published by the Bureau or the University.

Mine Safety Station. The Mine Safety Station of the United States Bureau of Mines is located in the new Federal Office Building on First Avenue at Madison Street. Apparatus for rescue and resuscitation is kept on hand for practice as well as for instant service. The senior safety instructor in charge of the Station gives instruction at Mines Laboratory to students in the College of Mines during the winter quarter. The applicant is taught the construction of the apparatus and is given practice in its use. First-aid instruction is also given. Applicants who have completed the course of training receive a certificate from the United States Bureau of Mines. An automobile truck equipped with rescue apparatus ready for emergency calls, forms part of the equipment of the Station.

Expenses

For information concerning University fees and expenses, see General Information bulletin.

REQUIREMENTS FOR ADMISSION

Correspondence. Credentials and all correspondence relating to admission to any college or school of the University should be addressed to the registrar, University of Washington. More detailed information concerning admission is contained in the General Information bulletin.

The opening date for registration of new students for the autumn quarter, 1937, has been postponed to August 2. Any new student will find it to his advantage to have his credentials on file not later than July 15. The student who delays submission of his credentials handicaps himself unnecessarily. Owing to the congestion of correspondence during the weeks immediately preceding the opening of the quarter, it is impossible to reply at once to letters and applications sent in during this period.

Students may not register until complete credentials from all schools formerly attended have been received and evaluated.

Students are admitted to the resident work of the University by certificate or by examination. Only recommended graduates of fully accredited four-year secondary schools are admitted on certificate. The University reserves the right to reject any application for cause. Students are classified as graduates, and undergraduates. Undergraduates are classified as regular students (freshmen, sophomores, juniors and seniors), unclassified students, and special students.

Admission by Certificate

A graduate of a four-year accredited secondary school, whose course has covered the requirements for entrance and who meets the scholarship requirement outlined in the General Information bulletin will be admitted upon the presentation of satisfactory credentials. Since school diplomas do not give the necessary information, they cannot be accepted for this purpose. Principals of all accredited high schools in this state are furnished with the necessary official blanks for submitting student credentials. They may also be obtained from the registrar's office. Credentials accepted toward admission to the University are kept on permanent file.

No student may be accepted for admission who would not be recommended to the university of his home state.

A graduate of a school system which provides for less than 12 years of instruction may be held for additional high school work.

Entrance Requirements

1. Graduation from an accredited high school or secondary school in the State of Washington.
2. Certification by the principal of the secondary work completed.
3. Graduates of a public accredited secondary school from outside of Washington will be admitted as regular students on the same terms as graduates of the accredited secondary schools of this state, except that (a) no such graduate shall be admitted who would not be accepted by the university of his own state, and (b) no such graduate shall be admitted who does not have a grade point average of 2.0 except on petition to the Committee on Admissions.
4. *Subject Requirements.* For entrance to the College of Mines the student must present twelve units* of credit, belonging normally to the 10th, 11th and 12th years of the high school curriculum, which must include the following:

*A "unit" is applied to work taken in the high school. To count as a unit, a subject must be taught five times a week, in periods of not less than forty-five minutes, for a school year of thirty-six weeks.

English	two units
Advanced algebra.....	one-half unit
Plane geometry.....	one unit
Solid geometry.....	one-half unit
Physics	one unit
Chemistry	one unit

The additional six units may be chosen from either academic or non-academic subjects. A student who does not present high school chemistry for entrance will normally be expected to earn fifteen credits instead of thirteen credits in chemistry during the freshman year.

A student is advised not to attempt to enter the University until he is able to register in his chosen college without deficiencies. Under certain circumstances and with the approval of the dean of the college concerned, however, certain deficiencies in specific college requirements may be removed after entrance in the University.

Students in any college electing work in the Naval Reserve Officers' Training Corps are required to present plane geometry and plane trigonometry. For the naval course in aviation flight training (entered at the beginning of the senior year), in addition to the above, the student must have had elementary physics, solid geometry and college algebra. In most cases, plane trigonometry and college algebra, may be taken during the freshman year, but the student who is planning to apply for admission to the Naval R.O.T.C. should take physics, plane and solid geometry and advanced algebra while in high school.

Admission by Examination

1. Certificate of successful examinations before the College Entrance Examination Board will be accepted. Students planning to enter the University by examinations shall arrange their selection of subjects so that they will have no deficiencies for the college they elect, *i.e.*, the University College, College of Engineering, etc.

2. Students who have not graduated from high school and who do not plan to do so must enter by examination. All examinations will be given by the College Entrance Examination Board.

3. Definite information regarding the necessary examinations may be obtained from the registrar of the University. Applications for these examinations should be made to the College Entrance Examination Board, 431 West 117th Street, New York, N. Y.

Admission to Advanced Standing

Applicants for advanced standing are required to furnish a complete official transcript of both preparatory and college credits, together with a letter of honorable dismissal from the institution last attended. (For information as to the scholarship required of transfer students, see the General Information bulletin.)

Accredited Schools

The University of Washington depends on the State Board of Education for lists of accredited public and private high schools for the State of Washington.

Schools Outside of Washington

Graduates of accredited high schools outside of Washington will be admitted as *regular students* on the same terms as graduates of the accredited high schools of Washington except that no such graduate shall be admitted

who would not be *accepted* by the university of his own state. The University reserves the right to refuse admission to students from any school whose graduates have consistently failed to make satisfactory records in the University.

Foreign Students

Students from schools in foreign countries and non-English speaking communities will be admitted under the same general conditions as those from American schools, provided they have a sufficient working knowledge of English, acquaintance with American methods of instruction, and plans of study, to enable them to carry college work successfully. An examination will be required by the registrar on these supplementary points.

Students from foreign schools whose standing is not known to be the equivalent of accredited American schools may be required to pass College Entrance Board examinations in representative subjects.

Preparation in Algebra

All students entering any department of engineering will be tested in high school algebra by class work and by an examination given shortly after the beginning of the first quarter. It is essential that students in the engineering courses shall possess a good working knowledge of algebra *at the beginning of their course*, and it is the purpose of the test to secure this by requiring a review of the subject shortly before entering the University. Students failing in the test are not permitted to continue with regular freshman engineering mathematics but are required to take a review of preparatory algebra (Math. 1, University College) during the first quarter.

Admission to Sophomore Year

All students in the College of Mines, other than first and second-quarter freshmen and new students, shall be placed on the low scholarship list and referred to the dean of the college for appropriate action whenever their grade-point average for any quarter is below 1.80.

No student whose grade-point average in the subjects regularly required in the freshman year of the College of Mines is below 1.80 shall be regularly admitted to the sophomore year. When such student has brought his grades to the required average he may apply to the dean for admission.

DEGREES

The College of Mines offers specialized courses in mining, metallurgical, and ceramic engineering. The four-year curricula lead to degrees as follows:

- I. Bachelor of science in mining engineering (B.S. in Min.E.).
- II. Bachelor of science in metallurgical engineering (B.S. in Met.E.).
- III. Bachelor of science in mining engineering and geology (B.S. in Min.E. and Geol.).
- IV. Bachelor of science in ceramic engineering (B.S. in Cer.E.).

Degree with Honors. A degree with honors may be conferred upon any student of the College of Mines who, upon vote of the faculty and of the honors committee, may be declared worthy of unusual distinction.

Masters' Degrees. The degrees of master of science in mining, metallurgical, and ceramic engineering, respectively, will be conferred upon graduates of this college or of other engineering colleges of recognized standing, who complete, in residence, one year (45 credits) of prescribed graduate work including a thesis, with grades of A or B. The candidate must comply with the regulations of the Graduate School and pass a formal examination open to all members of the faculty. The selection of work for this degree must in each case be approved by the head of the department and by the Graduate Council.

The degree of master of science in ceramics may be conferred upon a graduate from a college of recognized standing provided his undergraduate preparation includes suitable courses in science and ceramics but does not meet the requirements of the engineering degrees granted in this college.

Professional Degrees. The College of Mines offers the following professional degrees: Engineer of Mines (E.M.); Metallurgical Engineer (Met.E); Ceramic Engineer (Cer.E.). The requirements are as follows:

1. Five years of professional experience in the proper field after graduation with a good record from a 4-year course in this college; or five years of professional experience after award of a master's degree by this college, if the candidate does not hold a bachelor's degree from it.
2. Four years in positions of professional responsibility, of a character equivalent to those required for membership in the National Founder Engineering Societies. Teaching experience shall count in lieu of professional experience in the same ratio as now recognized by the professional societies, provided that a minimum of two years of acceptable engineering work other than teaching be included.
3. A professional thesis on a subject on which the applicant has been directly engaged. The thesis committee shall be the judge of the suitability of the material presented, which may be a published article or other writing having high professional value.
4. Submission of two complete copies of the thesis.

Application for a professional degree may be made at any time. It shall be accompanied by an exact statement of the applicant's record since graduation. The college of mining, metallurgical, and ceramic engineering will pass upon the application and may then arrange dates on which material is to be submitted for criticism. The candidate must submit his thesis in final form at least one month before the date on which theses for advanced degrees are deposited in the library. (See Rule 14 in catalog.) Final recommendation for or against the degree will be based upon the finished thesis. Action will be taken by the faculty of the College of Mines upon recommendation of the mines department.

CURRICULA OF THE COLLEGE OF MINES
MINING, METALLURGICAL, AND CERAMIC ENGINEERING
For the Freshman and Sophomore Years in all Curricula

Freshman

<i>Autumn Quarter</i>	<i>Credits</i>	<i>Winter Quarter</i>	<i>Credits</i>	<i>Spring Quarter</i>	<i>Credits</i>
Chem. 24. General.....	4	Chem. 25. General.....	4	Chem. 23. General.....	5
G.E. 1. Drawing.....	3	G.E. 2. Drawing.....	3	G.E. 3. Drafting	
G.E. 11. Engineering Problems	3	G.E. 12. Engineering Problems	3	G.E. 21. Surveying.....	3
Math. 31. Freshman Engineering	5	Math. 32. Freshman Engineering	5	Math. 33. Freshman Engineering	5
Military or Naval Science and Physical Education +		P.E. 15. Personal Health 2 Military or Naval Science and Physical Education +		Military or Naval Science and Physical Education +	

Sophomore

Min. 51. Elements of Mining.....	3	Mining 52. Methods....	3	Met. 53. Elements of Metallurgy	3
Geol. 5. Rocks and Minerals	5	Chem. 109 or 111. Quantitative Analysis. 5		Cer. 90. Industrial Minerals	3
Math. 41. Calculus.....	3	Comp. 100. Technical Composition	3	Geol. 121. Mineralogy..	5
Physics 97. Engineers'..	5	Physics 98. Engineers'..	5	Physics 99. Engineers'..	5
Military or Naval Science and Physical Education +		Military or Naval Science and Physical Education +		Military or Naval Science and Physical Education +	

Practice in mining or geology or metallurgy or ceramics in summer vacation.

MINING ENGINEERING

Leading to the Degree of Bachelor of Science in Mining Engineering.

Freshman and Sophomore

(The same for all curricula. See above.)

Junior

<i>Autumn Quarter</i>	<i>Credits</i>	<i>Winter Quarter</i>	<i>Credits</i>	<i>Spring Quarter</i>	<i>Credits</i>
Min. 101. Milling.....	3	Met. 103. Fuels.....	4	Min. 106. Mine Excursion	1
Met. 101. Fire Assaying. 3		Geol. 124. Petrography..	3	Met. 102. Metallurgical Laboratory	2
Met. 104. Non-ferrous..	3	C.E. 92. Mechanics.....	3	Met. 153. Wet Assaying	3
Geol. 123. Optical Mineralogy	3	E.E. 101-102. Direct Currents	6	E.E. 121-122. Alternating Currents	6
C.E. 91. Mechanics.....	3			Elective	3

Mining practice in summer vacation.

Senior

Min. 151. Mining Engineering	3	Min. 103. Mine Rescue Training	1	Min. 107. Mine Excursion	1
Min. 191. Thesis.....	2	Min. 162 Economics....	4	Min. 152. Mineral Dressing	5
Met. 155. Iron and Steel	3	Min. 192. Thesis.....	2	Min. 182. Mineral Industry Management..	3
Met. 162. Physical Metallurgy	3	Geol. 127. Economic Geology	5	Min. 193. Thesis.....	1
Elective	4	E.B. 3. General Economics	3	Elective	5

Electives must in all cases be approved in advance by the head of the department.
 For non-technical electives, see page 20.

METALLURGICAL ENGINEERING

Leading to the Degree of Bachelor of Science in Metallurgical Engineering.

Freshman and Sophomore

(The same for all curricula. See above.)

Junior

<i>Autumn Quarter</i>	<i>Credits</i>	<i>Winter Quarter</i>	<i>Credits</i>	<i>Spring Quarter</i>	<i>Credits</i>
Met. 101. Fire Assaying	3	Met. 103. Fuels.....	4	Met. 102. Metallurgical Laboratory	2
Met. 104. Non-ferrous..	3	Met. 153. Wet Assaying	3	Min. 106. Mine Excursion	1
Min. 101. Milling.....	3	E.E. 101-102. Direct Currents	6	E.E. 121-122. Alternating Currents	6
C.E. 91. Mechanics.....	3	C.E. 92. Mechanics.....	3	E.B. 3. General Economics	3
Elective	3			Elective	3

Metallurgical practice in summer vacation.

Senior

Met. 155 Iron and Steel	3	Met. 163. Metallography	3	Met. 166. Advanced Non-ferrous	3
Met. 162. Physical Metallurgy	3	Met. 165. Metallurgical Calculations	3	Min. 107. Mine Excursion	1
Min. 151. Mining Engineering	3	Min. 103. Mine Rescue Training	1	Min. 152. Ore Dressing.	5
Min. 191. Thesis.....	2	Min. 162 Economics....	4	Min. 193. Thesis.....	1
Elective	4	Min. 192. Thesis.....	2	Elective	4
		Chem 140. Elementary Physical	3		

Electives must in all cases be approved in advance by the head of the department.
For non-technical electives, see page 20.

MINING ENGINEERING AND GEOLOGY

Leading to the Degree of Bachelor of Science in Mining Engineering and Geology.

Freshman and Sophomore

(The same for all curricula. See above.)

Junior

<i>Autumn Quarter</i>	<i>Credits</i>	<i>Winter Quarter</i>	<i>Credits</i>	<i>Spring Quarter</i>	<i>Credits</i>
Min. 101. Milling.....	3	Met. 103. Fuels.....	4	Min. 106. Mine Excursion	1
Met. 101. Fire Assaying	3	Geol. 106. Physiography	5	Met. 153. Wet Assaying.	3
Met. 104. Non-ferrous..	3	Geol. 124. Petrography..	3	Geol. 107. Historical Geology	5
Geol. 123. Optical Mineralogy	3	C.E. 92. Mechanics....	3	Geol. 125. Petrology...	3
C.E. 91. Mechanics.....	3			E.B. 3. General Economics	3

Mining or geology practice in summer vacation.

Senior

Min. 151. Mining Engineering	3	Min. 103. Mine Rescue Training	1	Min. 107. Mine Excursion	1
Min. 191. Thesis.....	2	Min. 162 Economics....	4	Min. 152. Ore Dressing	5
Met. 162. Physical Metallurgy	3	Min. 192. Thesis.....	2	Min. 182. Mineral Industry Management.....	3
Elective	7	Geol. 127. Economic Geology of Metals....	5	Min. 193. Thesis.....	1
		Elective	3	Elective	5

Electives must in all cases be approved in advance by the head of the department.
For non-technical electives, see page 20.

CERAMIC ENGINEERING

Leading to the Degree of Bachelor of Science in Ceramic Engineering.

Freshman and Sophomore

(The same for all curricula. See above.)

Junior

<i>Autumn Quarter</i>	<i>Credits</i>	<i>Winter Quarter</i>	<i>Credits</i>	<i>Spring Quarter</i>	<i>Credits</i>
Cer. 100. Plasticity, Suspensions and Drying... 3		Cer. 101. Firing..... 3		Cer. 102. Ceramic Decoration 3	
Cer. 104. Calculations for Bodies and Glazes.... 3		Cer. 105. Calculations for Drying and Firing... 3		Cer. 110. Ceramic Physical-Chemical Measurements 3	
Min. 101. Milling..... 3		Met. 103. Fuels..... 4		Min. 106. Mine Excursion 1	
C.E. 91. Mechanics..... 3		C.E. 92. Mechanics..... 3		Met. 102. Metallurgical Laboratory 2	
Geol. 123. Optical Mineralogy 3		Elective 3		E.B. 3. General Economics 3	
				Elective 3	

Ceramics practice in summer vacation.

Senior

Cer. 121. Ceramic Products Laboratory 5		Cer. 122. Ceramic Products Laboratory 5		Cer. 123. Ceramic Products Laboratory 5	
Min. 191. Thesis..... 3		Min. 103. Mine Rescue Training 1		Min. 107. Mine Excursion 1	
Met. 162. Physical Metallurgy 3		Min. 192. Thesis..... 3		Min. 193. Thesis..... 2	
Elective 4		Chem. 140. Elementary Physical 3		Chem. 141. Elementary Physical 3	
		Elective 3		Elective 4	

Suggested electives for students especially interested in

Mining Engineering: Min 171; M.E. 81, 82, 83; C.E. 59, 142.

Coal Mining: Min. 122, 171, 176; M.E. 81, 82, 83.

Metallurgy: Chem. 141.

Ceramics: Cer. 131, 132, 133; 161, 162, 163; Min. 152, 162; Geol. 124, 125, 128; Physics 109.

General electives: Comp. 102, Speech 103, modern foreign language, E.B. 57.

Electives must in all cases be approved in advance by the head of the department.

For non-technical electives, see page 00.

Description of these courses, with all those offered in any school or college of the University, will be found in the section of the catalogue known as Departments of Instruction (also published separately).

COURSES OF STUDY

MINING ENGINEERING

51. *Elements of Mining.* The field of mining, considering prospecting and boring, drilling, explosives, rock breaking, and principles applying to open-pit and underground methods. Prerequisite, sophomore standing. Three recitations. Three credits; autumn. Daniels.

52. *Methods of Mining.* Continuation of Min. 51. Methods of working metal, coal, and placer mines, quarries, and clay deposits. Prerequisite, Min. 51. Two recitations and one laboratory period. Three credits; winter. Daniels.

101. *Milling.* Preliminary course in the principles of mineral dressing; practice with the milling machinery in Mines Laboratory. Prerequisite, junior engineering standing. Two recitations and one laboratory period. Three credits; autumn. Roberts.

103. *Mine Rescue Training.* Practice in the use of oxygen rescue apparatus, and instruction in first-aid; 25 hours of intensive instruction during first three weeks of quarter. Physical examination required. A government certificate is granted on completion of course. One credit; winter. Daniels.

106. *Mine Excursion*. A five-day trip in spring of junior year to a neighboring mining region; detailed inspection of mines. Expense approximately \$25. One credit; spring. Roberts, Daniels.

107. *Mine Excursion*. A five-day trip in spring of senior year, similar to Min. 106. One credit; spring. Roberts, Daniels.

122. *Coal Mining Methods*. Special methods involved in prospecting, development, and operation of coal and stratified deposits. Detailed studies are made at nearby mines. Prerequisite, Min. 51 and Min. 52. Three recitations. Three credits; winter. Daniels.

151. *Mining Engineering*. Principles and practice as exemplified at typical mines. Laboratory studies of air compressors, drills, etc.; studies at nearby mines. Prerequisite, senior engineering standing. Two recitations, one laboratory period. Three credits; autumn. Roberts.

152. *Mineral Dressing*. The principal branches of mineral dressing, with laboratory practice in complete mill tests. Prerequisite, senior standing. Three recitations and two laboratory periods. Five credits; spring. Roberts.

162. *Economics of the Mineral Industry*. A continuation of Min. 151 but with emphasis on the economics of the industry. Prerequisite, senior engineering standing. Three recitations and one laboratory period. Four credits; winter. Roberts.

*163. *Mine Operation*.

171. *Mine Ventilation*. Composition and properties of mine gases; principles of ventilation; safety and physiological factors applied to both coal and metal mines. Prerequisites, Min. 51, 52, and 103. Three recitations. Three credits; spring. Daniels.

176. *Coal Preparation*. Methods of preparing coal by dry and wet cleaning processes; control by float-and-sink methods. Field examinations of washing plants at local mines. Prerequisites, Min. 101, and Met. 103. Two recitations and two 4-hour laboratory periods. Five credits; spring. Daniels.

182. *Mineral Industry Management*. Employment of labor, systems of payment, efficiency of labor and methods, social and economic aspects of mineral engineering operations. Prerequisite, senior engineering standing. Three recitations. Three credits; spring. Daniels.

191, 192, 193, 194. *Thesis*. Preparation of a graduation thesis in mining, metallurgy, or ceramics. Completed thesis is due one month before graduation. Prerequisite, senior standing. A minimum total of five credits allowed for thesis. Hours and credits to be arranged; autumn, winter, spring, summer. Roberts, Daniels, Corey, Wilson.

Courses for Graduates Only

201, 202, 203. *Seminar*. Lectures and discussions by Bureau of Mines staff, mining engineering faculty and fellows. Required of fellowship holders in the College of Mines. Prerequisite, graduate standing. One credit; autumn, winter, spring. Staff.

211, 212, 213, 214. *Graduate Thesis*. Preparation of a thesis in mining, metallurgy, or ceramics. Prerequisite, graduate standing. Complete thesis is due at least one month before graduation. Hours and credits to be arranged; total nine credits allowed for thesis. Autumn, winter, spring, summer. Roberts, Daniels, Corey, Wilson.

*Not offered in 1937-1938.

221, 222, 223. *Metal Mining*. Studies in metal mining. Prerequisite, graduate standing. Hours and credits to be arranged. Roberts.

231, 232, 233. *Mineral Dressing*. Studies in ore dressing. Prerequisite, graduate standing. Hours and credits to be arranged. Roberts.

251, 252, 253. *Coal Mining*. Studies in coal mining or in the preparation of coal. Prerequisite, graduate standing. Hours and credits to be arranged. Daniels.

261, 262, 263. *Fuels and Combustion*. A course in fuels, their utilization and combustion. Prerequisite, graduate standing. Hours and credits to be arranged. Daniels.

271. *Cooperative Research with U. S. Bureau of Mines*. Investigations by holders of cooperative fellowships in College of Mines and Northwest Experiment Station. Six credits; autumn. Staff.

METALLURGICAL ENGINEERING

53. *Elements of Metallurgy*. Properties of metals and alloys, fuels, refractory materials, furnaces, the extraction of the common metals from their ores. Open to all engineering students with sophomore standing. Prerequisite, Chem. 23. Three recitations. Three credits; spring. Corey.

101. *Fire Assaying*. Testing of reagents, crushing, sampling, and assaying of ores, furnace, and mill products. Prerequisite, Chem. 23. One recitation and two laboratory periods. Three credits; autumn. Corey.

102. *Metallurgical Laboratory*. Experiments illustrating metallurgical principles. Prerequisite, Met. 53. One 4-hour laboratory period. Two credits; spring. Corey.

103. *Fuels*. Primary and manufactured fuels; source, composition methods of utilization, economy, relative values, and efficiencies. Laboratory work in analysis of common fuels. Prerequisite, junior standing. Three recitations and one laboratory period. Four credits; winter. Daniels, Corey.

104. *Non-ferrous Metallurgy*. Metallurgy of copper, lead, zinc, gold and silver, especially the methods of roasting, smelting, lixiviation and refining. Prerequisite, Met. 53. Three recitations. Three credits; autumn. Corey.

140. *Materials of Construction*. Methods of manufacture, properties, and engineering uses of ferrous and non-ferrous metals and alloys, and ceramic materials. Prerequisite, junior standing. Three lectures. Three credits; autumn. Corey, Daniels, Wilson.

153. *Wet Assaying*. Technical methods for the determination of copper, lead, zinc, and other substances, in ores and furnace products. Prerequisite, Chem. 109, 110, or 111. One recitation and two laboratory periods. Three credits; winter, spring. Corey.

155. *Iron and Steel*. Metallurgy and manufacture of commercial iron and steel; especially, their properties and uses in engineering work. Prerequisite, junior engineering standing. Three recitations. Three credits; autumn. Daniels.

160. *Metallurgical Analysis*. Technical methods of analysis of slags, industrial products and (for ceramics and geology students) clays and rocks. Prerequisite, Chem. 109, 110, or 111. Two laboratory periods. Two credits; spring. Corey.

162. *Physical Metallurgy*. The constitution of metals and alloys, and their relations to the physical and mechanical properties of the metal. Prerequisite, senior engineering standing. Open to all upperclass engineering students. Three recitations. Three credits; autumn. Corey.

163. *Metallography*. Preparation and study of metal sections, photomicrography and the use of the microscope in testing industrial alloys. One recitation and two laboratory periods. Open to all upperclass engineering students. Three credits; winter. Corey.

165. *Metallurgical Calculations*. Physical chemistry of the metallurgist, slag calculations, and furnace problems. Prerequisite, junior mines standing. Three recitations. Three credits; winter. Corey.

166. *Advanced Non-ferrous Metallurgy*. Study of methods and practice in the extraction of the minor non-ferrous metals. Prerequisite, senior mines or graduate standing. Three credits; spring. Corey.

Courses for Graduates Only

221, 222, 223. *Advanced Metallurgy*. Studies in metallurgy. Prerequisite, graduate standing. Hours and credits to be arranged. Corey.

CERAMIC ENGINEERING

90. *Industrial Minerals*. Origin, occurrence, physical properties, and preparation of materials used in the ceramic and non-metallic industries. Prerequisite, sophomore standing in mines, engineering, or science. Three recitations. Three credits, autumn, winter, spring. Wilson.

100. *Plasticity, Suspensions, and Drying*. Physical characteristics of ceramic materials in the plastic condition and as slip-suspensions. Prerequisite, Cer. 90. Three recitations. Three credits; autumn. Wilson.

101. *Firing*. The effect of heat on ceramic materials; vitrification of clay; melting, fusion, and crystallization of silicates. Prerequisite, Cer. 100. Three recitations. Three credits; winter. Wilson.

102. *Ceramic Decoration*. The value of decoration in ceramics. Ceramic colors, surface textures and glazes. The chemistry of color production. Prerequisite, Cer. 101. Three recitations. Three to six credits; spring. Wilson.

104. *Calculations for Bodies and Glazes*. Physics and chemistry of preparing, drying, firing, testing and designing ceramic materials and glazes. Prerequisite, junior standing in mines or engineering. Three recitations. Three credits; autumn. Wilson.

105. *Calculations for Drying and Firing*. Problems in the physics and chemistry of drying, firing, and the combustion of fuel. Prerequisite, junior standing in mines or engineering. Three recitations. Three credits; winter. Wilson.

110. *Ceramic Physical-Chemical Measurements*. Laboratory testing of clays and other ceramic materials. Prerequisite, junior standing in mines or engineering. Two laboratory periods. Two credits; spring. Wilson.

121, 122, 123. *Ceramic Products Laboratory*. Laboratory problems in preparing raw materials, and the manufacture and testing of ceramic and non-metallic products. Prerequisite, Cer. 90 to 110. Two recitations and three laboratory periods. Five credits a quarter; autumn, winter, spring. Wilson.

131, 132, 133. *General Ceramics*. Industrial and craft methods of manufacturing ceramic products, mainly architectural terra cotta and pottery; decorative processes; glaze studies. No prerequisites. One recitation and two laboratory periods. Three credits; autumn, winter, spring. Wilson, Denny.

161, 162, 163. *Glazes, Enamels and Colors*. Laboratory problems in glazes and enamels with application to clay and metal surfaces. Problems in ceramic color production and control. Hours and credits to be arranged; autumn, winter, spring. Wilson.

Courses for Graduates Only

221, 222, 223. *Ceramic Research*. Studies of the ceramic resources of the Pacific Northwest or in the development of new products or processes. Prerequisite, graduate standing. Hours and credits to be arranged. Wilson.

**SUBJECTS PRESENTED BY DEPARTMENTS OF OTHER
COLLEGES OF THE UNIVERSITY****Required Courses***Chemistry*

- 24-25. General Chemistry. Four credits a quarter; autumn-winter.
- 23. General Chemistry. Five credits; autumn, winter, spring.
- 109. Quantitative Analysis. Five credits a quarter; autumn, winter
- 111. Quantitative Analysis. Five credits a quarter; autumn, spring.
- 140-141. Elementary Physical. Three credits a quarter; winter-spring.

Economics

- 3. General Economics. Three credits; autumn, winter, spring.

Engineering, General

- 1, 2, 3. Engineering Drawing. Three credits a quarter; autumn, winter
spring.
- 11, 12. Engineering Problems. Three credits a quarter; autumn, winter
spring.
- 21. Plane Surveying. Three credits; autumn, winter, spring.

Engineering, Civil

- 91, 92. Mechanics. Three credits; autumn, winter, spring.

Engineering, Electrical

- 101, 102. Direct Current. Four credits; autumn, winter, spring; labora-
tory, two credits; autumn, winter, spring.
- 121, 122. Alternating Currents. Four credits; autumn, winter, spring;
laboratory, two credits; autumn, winter, spring.

English

Composition

- B. Elementary composition for students in engineering and mining. A
non-credit course for students who need additional preparation be-
fore entering Comp. 100; autumn, winter, spring.
- 100. Technical Composition. Three credits; autumn, winter, spring.

Geology

- 5. Rocks and Minerals. Five credits; autumn.
- 106. Principles of Physiography. Five credits; winter.
- 107. Principles of Historical Geology. Five credits; spring.
- 121. Mineralogy. Three credits; autumn.
- 123. Optical Mineralogy. Three credits; autumn.
- 125. Petrography. Three or five credits; winter.
- 125. Petrology. Three or five credits; spring.
- 127. Ore Deposits. Five credits; winter.

Mathematics

- 31, 32, 33. Engineering Freshman Mathematics. Five credits a quarter;
autumn, winter, spring.
- 41. Calculus. Three credits a quarter; autumn, winter, spring.

Military Science and Tactics or Naval Science and Physical Education

A course of two years in military or naval science and physical education is required. See Rules 17, 18, 19, in General Information bulletin.

Physical Education

15. Personal Health. Two credits; autumn, winter, spring.

Physics

97. Physics for Engineers. Five credits; autumn, winter.
98. Physics for Engineers. Five credits; winter, spring.
99. Physics for Engineers. Five credits; autumn, spring.

Electives*Astronomy*

1. Astronomy. Five credits; autumn, spring.

Chemistry

- 140-141. Elementary Physical. Three credits a quarter; winter-spring.

Economics

57. Business Law. Three credits, autumn, spring.
62, 63. Principles of Accounting. Five credits; autumn, winter, spring.
121. Corporation Finance. Five credits; autumn, winter, spring.
122. Principles of Investment. Five credits; autumn, winter.

Engineering, Civil

59. Advanced Surveying. Four credits; spring.
142. Hydraulics. Five credits; autumn, winter, spring.

Engineering, Mechanical

- 53, 54, 55. Metal Work. One credit a quarter; autumn, winter, spring.
81, 82, 83. Three credits a quarter; autumn, winter, spring.

*English**Composition*

102. English for Engineers. Three credits; autumn, winter, spring.

Literature

- 64, 65. Literary Backgrounds. Five credits; autumn, winter, spring.
73. Introduction to Modern Literature. Five credits; autumn, winter, spring.
97, 98, 99. The Bible as Literature. Two credits; autumn, winter, spring.
104, 106. Contemporary Literature. Three credits; autumn, winter, spring.
141, 142, 143. Social Ideals in Literature. Three credits; autumn, winter, spring.
164, 165, 166. American Literature Since 1870. Three credits; autumn, winter, spring.

Speech

- 40. Essentials of Speaking. Five credits; autumn, winter, spring.
- 43. The Speaking Voice. Three credits; autumn, winter, spring.
- 103. Extemporaneous Speaking. Three credits; spring.

French

- 4, 5, 6. Second Year Reading. Prerequisite, two years of French in high school or equivalent. Three credits; autumn, winter, spring.
- 137, 138, 139. Scientific French. Prerequisite, French 6 or equivalent. Two credits; autumn, winter, spring.

Geography

- 102. Geography of North America. Five credits; autumn.
- 170. Conservation of Natural Resources. Five credits; winter.

Geology

- 122. Field Methods. Five credits; spring.
- 128. Mineral Resources—Non-metals. Three credits; spring.
- 130. General Paleontology. Five credits; winter.
- 131. Stratigraphy. Three credits; winter.
- 142. Structural Geology. Five credits; winter.

German

- 5. Second Year Reading. Prerequisite, two years in high school or equivalent. Three credits; autumn, winter, spring.
- 60, 61. Lower Division Scientific German. Three credits; autumn, winter, spring.

History

- 5. English Political and Social History. Five credits; autumn, winter.
- 144, 145. History of the United States. Five credits; winter, spring.
- 149, 150. History of National Development. Five credits; autumn, winter.

Liberal Arts

- 1. Introduction to Modern Thought. Five credits; autumn, spring.
- 11. Introduction to the study of the Fine Arts. Five credits; winter, summer.

Modern Language

For description of courses in modern languages see the statements of the modern language department in the Departments of Instruction bulletin.

Music

- 22, 23, 24. Music Appreciation (for non-music majors). Two credits; autumn, winter, spring.

Philosophy

- 1. Introduction to Philosophy. Five credits; autumn, winter, spring.
- 2. Introduction to Social Ethics. Five credits; winter.
- 5. Introduction to Logic. Five credits; autumn, winter.

Physics

- 101-102. Introduction to Modern Physics. Three credits; autumn, winter.
- 115. Photography. Three credits; spring.

Physiology

- 53. Intermediate Physiology. Five credits; autumn.
- 54. Intermediate Physiology. Five credits; winter.

Political Science

- 111. History of Political Theory. Five credits; autumn.
- 113. Contemporary Political Thought. Five credits; spring.
- 121. Foreign Relations of the United States: Europe. Three credits; winter.
- 127. International Organization and Administration. Five credits; winter.
- 155. Introduction to Public Administration. Five credits; autumn.
- 156. Parliamentary Government in Europe. Five credits; spring.

Psychology

- 1. General Psychology. Five credits; autumn, winter, spring.
- 121. Applied Psychology. Five credits; winter.

Sociology

- 1. Survey of Sociology. Five credits; autumn, winter, spring.
- 140. Population. Three credits; autumn.
- 150. General Sociology. Five credits; autumn.

Zoology

- 16. Evolution. Two credits; autumn.
- 17. Eugenics. Two credits; winter, spring.

Description of these courses, with all those offered in any school or college of the University, will be found in the section of the catalogue known as Departments of Instruction (also published separately).

UNIVERSITY PUBLICATIONS

The University of Washington Bulletin (general series) includes the general catalogue, bulletins of the colleges and schools, University Directory (price \$1), Extension Service, General Information, University News Letter, Oceanographic Laboratories, Summer Quarter, Time Schedule, Vocational Information (price 50 cents). The general catalogue is limited to exchange purposes; the college bulletins are distributed without charge.

The following series are published at irregular intervals and are sold for stated charges. Persons wishing to obtain any of these publications are requested to correspond with the publications editor. Libraries or institutions offering material of equivalent value may secure exchanges by corresponding with the University librarian.

The University of Washington Publications contain the results of research in various departments of the University. These publications include the following series: Anthropology, Biology, Geology, Language and Literature, Mathematics and the Social Sciences.

The Publications of the Engineering Experiment Station include the bulletins of information and investigation concerning engineering and scientific problems.

The Publications in Oceanography are based on the investigational work carried on at the Friday Harbor Station, as well as on the University of Washington campus.

The Extension Service Series includes monographs of interest and value to the layman. While authentic, they are not written in highly technical terms with which the general public is unfamiliar.

The College of Education Record is published monthly during the school year. It contains articles on progressive practices in education of interest to administrators in general, as well as specialized material particularly for school men in the Pacific Northwest.

The Pacific Northwest Quarterly is a quarterly magazine devoted to the publication of articles and materials dealing with all phases of the history of the Pacific Northwest.

HARRIETT WESTMORELAND, *Publications Editor*

UNIVERSITY OF ILLINOIS-URBANA



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